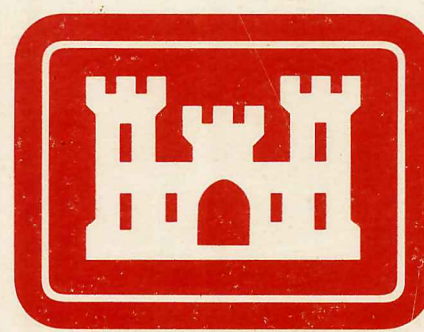


FORT LEONARD WOOD, MISSOURI

TERRAIN ANALYSIS



PREPARED BY

GREENHORNE & O'MARA, INC.

RIVERDALE, MARYLAND

UNDER THE DIRECTION OF

THE TERRAIN ANALYSIS CENTER

US ARMY ENGINEER TOPOGRAPHIC LABORATORIES

FORT BELVOIR, VIRGINIA 22060

JANUARY 1982

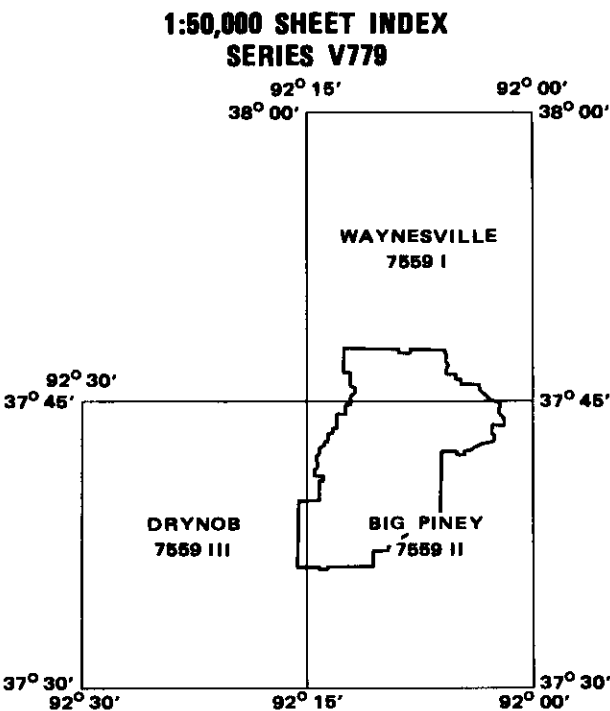
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CONTRACT NUMBER DACA 87-81-C-0079

JANUARY 1982

extra

I. INTRODUCTION

BACKGROUND

The requirement for this terrain analysis of Fort Leonard Wood was validated by the Assistant Chief of Staff for Intelligence, Department of Army, included in the five-year Terrain Analysis Program, and assigned as part of the program element, "Terrain Analysis of Selected CONUS Army Installations." Responsibility for management and supervision of this program element developed in response to FORSCOM and TRADOC requirements and was assigned to the Terrain Analysis Center (TAC), U.S. Army Engineer Topographic Laboratories. TAC responsibility also included technical supervision and direction of designated troop units assigned to the program.

Scope and content of the topical coverage included in the terrain analyses of selected CONUS installations were developed jointly between representatives of TAC and FORSCOM, and later concurred in by TRADOC.

This study was prepared by Greenhorne & O'Mara, Inc., Riverdale, Maryland (Contract No. DACA87-81-C-0079) under the direction of TAC.

PURPOSE

The major purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes, among other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies.

Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These items are also treated in the studies.

Because the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. Some of the information contained in the studies may be useful as environmental baseline data, but the studies are by no means complete environmental inventories of the kind required in support of the environmental impact assessments.

SCOPE

In scope, the terrain analysis is a compendium of available data on the pertinent natural and manmade features of the reservation and an evaluation of their effects on tactical military operations. The program does not include basic research to fill gaps in these data although some short term field investigations were performed to obtain ground truth and a general overall appreciation of terrain elements. Therefore, the scope of the analysis is limited primarily to those factors which have been documented by other authorities and to the results of analysis and evaluation of those factors by senior terrain analysts for topics such as cross-country movement, cover and concealment, and water resources.

The terrain analysis preparation process has necessarily involved analytical judgment in the selection of pertinent source data, resolution of data conflicts, recognition of interrelationships not previously made explicit, and the application of remote sensing to update certain critical, time-variant data such as vegetative cover and manmade features including roads, airfields, and facilities constructed outside of the cantonment area.

LIMITATIONS

The study naturally reflects limitations in the quality, amount, and currency of the source data on which it is based. Numerous field interviews and selective use of remote sensing were employed in an effort to assure presentation of the latest and best information. Within the relatively complex topical scope of the analysis, however, there are a number of aspects on which source data have not been generated with the focus or recency desired to meet objectives fully. As noted under Scope, the study effort was not designed to include basic research as a means of filling gaps in data.

By design, the presentation is cast at a level of data coverage consistent with stated objectives. Users interested in deeper pursuit of data are referred to the List of Sources in the back of the study.

PRESENTATION

Maximum use of graphic presentation has been made throughout the terrain analysis. Supporting text is, as far as practicable, in tabular format keyed to the related graphics which follow. The primary map scale is 1:50,000. For Urban Area (Cantonment Area), the scale of the map is 1:16,200 and for Off-Post Features the map scale is 1:1,000,000.

STUDY AREA

The Fort Leonard Wood military reservation is in southern Missouri, approximately 193 kilometers (120 miles) southwest of St. Louis, Missouri, and 117 kilometers (73 miles) northeast of Springfield, Missouri. The reservation extends approximately 21.5 kilometers (13.4 miles) north-south and approximately 15.9 kilometers (9.9 miles) east-west at its widest point, and covers an area of 27,748 hectares (68,564 acres). Fort Leonard Wood lies almost entirely within Pulaski County, but includes very small areas of Laclede County and Texas County along the southwestern boundary of the reservation. The primary highway access is Interstate 44 which connects with the reservation by a four-lane divided highway spur.

The Fort Leonard Wood reservation is within the Salem Plateau section of the Ozark Plateaus Province of the Interior Highlands. The north-central to south-central parts of the reservation are level to gently rolling, partially dissected upland plains of low to moderate relief. The remaining eastern and western parts of the reservation consist of strongly rolling to steep, highly dissected surfaces adjacent to alluvial stream valleys. The highest elevation is 339 meters (1309 feet) along Route 1 south of Bloodland in the south-central part of the reservation. The lowest elevation is 230 meters (755 feet) along the banks of Big Piney River at the northeast corner of the reservation. Vegetation varies from short grass on flood plains and in the middle of the reservation, to a large expanse of dense, deciduous forest covering over half of Fort Leonard Wood. The two major streams on Fort Leonard Wood, Big Piney River and Roubidoux Creek, flow from south to north, draining into the Gasconade River approximately 8 kilometers (5 miles) north of the reservation. The reservation is bordered on the south, west, and east by Mark Twain National Forest.

The climate of the area is temperate with warm summers and mild winters. The mean annual precipitation is about 102 centimeters (40 inches); the highest amount of precipitation occurs in the spring and early summer, sometimes followed by hot summer droughts in July and August. The greatest threat of severe weather is during May through August when over 60 percent of the thunderstorms normally occur.

II. DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

A. SURFACE CONFIGURATION

Fort Leonard Wood is in the Springfield-Salem Plateau Section of the Ozark Plateaus Province of the Interior High-lands. The section is an elevated plain uplifted at the beginning of the Pleistocene Epoch and has been deeply eroded by stream action and groundwater solution of the predominantly dolomite bedrock.

The landform features common to the karst topography of the area include caves, springs, underground rivers, and sinkholes. Another significant characteristic of the Springfield-Salem Plateau is its relatively large local relief. This is evident by the 120m (394 ft) vertical difference between the Big Piney River valley in the northeast (grid reference 840767) and the higher part of the cantonment area (grid reference 769788).

Low plains in the north-central part of Fort Leonard Wood are characterized by level to gently rolling, moderately dissected surfaces with numerous sinkholes. Broad alluvial valleys occupied by the Big Piney River and Roubidoux Creek are generally level. Hurd and Musgrave Hollows are narrow, gently rolling, moderately dissected stream valleys. High plains, comprising approximately 80 percent of the reservation, have predominantly gently to moderately rolling surfaces; considerably more dissected as small tributaries approach the Big Piney River and Roubidoux Creek. Locally, deeply dissected areas are interrupted by a series of limestone capped escarpments generally parallel to the main streams.

LANDFORM TYPE	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATION
1. Low plains	<p>Level to gently rolling surfaces of low relief predominate from the north-central to south-central parts of the reservation in alluvial stream valleys of the east, northwest and southwest. Slopes are largely between 0 and 3 percent, but locally may be up to 15 percent in moderately dissected stream valleys and the south-central sector. Local relief is largely between 35 and 50m (115 and 164 ft) throughout the low plains.</p> <p>The cantonment area in the north-central part of the reservation is situated on a level to gently rolling surface with slopes predominantly 0 to 3 percent. South of the cantonment area, where surfaces are moderately dissected, slopes range from 3 to 8 percent. Local relief within the cantonment area averages 5m (15 ft).</p> <p>The largest area of low plains is located from the north-central to south-central part of the reservation centered along Iowa Avenue (Fort Leonard Wood Route I). Big Piney River and Roubidoux Creek are in nearly level alluvial valleys with local relief of approximately 10m (32 ft). Slopes are largely 0 to 8 percent, but locally may range up to 15 percent in moderately dissected areas adjacent to Roubidoux Creek. Hurd and Musgrave Hollows are narrow, gently rolling, moderately dissected, stream valleys; slopes are generally 3 to 15 percent and local relief averages approximately 15m (49 ft) in the valley floor.</p>	<p>Elevations in the low plains range largely between 235 and 355m (770 and 1164 ft) above sea level. The north-central to south-central part of the reservation has the higher elevations 332m, (grid reference 781809) to 386m (grid reference 732674) (1089 to 1266 ft). In the northeast, elevations range between 235 and 240m (771 to 781 ft) above sea level in the Big Piney River valley. In the northwest and southwest, elevations are between 265 and 315m (869 and 1033 ft).</p> <p>The lowest elevation in the cantonment area, 332m (1089 ft), is approximately 180m (590 ft) southeast of sub-station No. 1 (grid reference 781809). The lowest elevation in the reservation occurs in the Big Piney River valley (grid reference 826779) at the north-east corner of the reservation, 230m (755 ft).</p>
2. High plains	<p>Gently to moderately rolling, moderately dissected surfaces predominate. Slopes are largely 8 to 15 percent, locally to 45 percent and greater along escarpments and deeply incised tributaries. Strongly rolling to steep, deeply dissected surfaces predominate adjacent to alluvial stream valleys in the northeast and west. Local relief is largely 55 to 80m (180 to 262 ft), locally to 110m (360 ft).</p> <p>Near the cantonment area the high plain is moderately rolling and gently dissected in contrast to the strongly rolling and deeply dissected surfaces immediately adjacent to Big Piney River and Roubidoux Creek. Slopes are largely 8 to 15 percent, but occasionally exceed 45 percent along rocky escarpments. Local relief is predominantly 55 to 95m (180 to 311 ft).</p> <p>Adjacent to the Big Piney River valley in the northeast, and Roubidoux Creek stream valley in the west and north-west, there are numerous deeply dissected, steep-sided ridges. Slopes are largely between 8 and 15 percent; however, slopes often exceed 45 percent along a series of escarpments adjacent to the stream valleys. Slopes locally exceed 100 percent along other escarpments, such as those near Wildcat Shoal (grid reference 835768) and Stone Mill Spring (grid reference 846776) in the northeastern part of the reservation. Local relief is largely between 55 and 95m (180 to 311 ft). Maximum local relief is approximately 105m (344 ft) near Decker's Point (grid reference 787827).</p>	<p>Elevations range largely between 300 and 385m (984 and 1263 ft) above sea level. The lowest elevation, approximately 264m (868 ft) (grid reference 738799), occurs in Ballard Hollow in the northern part of the reservation. The highest elevation is approximately 399m (1309 ft) above sea level, occurring in the south-central part of the reservation near Range 24 (grid reference 741687) and in the southwest along Route UB near the Pulaski and Laclede County boundary (grid reference 664664).</p>

B. SURFACE DRAINAGE

Fort Leonard Wood is in the drainage basin of the Gasconade River. Principal streams draining the reservation are the Big Piney River along the eastern reservation boundary and Roubidoux Creek at the western boundary. Both streams originate to the south of the reservation and flow northward to the Gasconade River. The drainage pattern of both basins is dendritic. The drainage divide between Big Piney River and Roubidoux Creek generally follows Route I through the center of the reservation. Big Piney River and Roubidoux Creek are the only perennial streams on the reservation. Roubidoux Creek is unusual in that much of the year it flows underground from a point near grid reference 665704 only to reappear north of the reservation near Waynesville, Missouri. Many of the other streams are intermittent with extended flows in the spring and generally lasting less than a week during the rest of the year. The smallest streams are ephemeral, flowing from hours to a few days after substantial snowmelt, intense or extended rainfall. A few streams may maintain a small flow for periods longer than their contributing drainage area would dictate due to flow from springs. Numerous small sinkholes are apparent over the entire reservation which characterizes its karst topography. The sinkholes may or may not contain water depending on the permeability of the underlying soil and the season of the year.

The highest flow period for the perennial streams is historically in the spring with lowest flows in late summer and early fall. The mean monthly flows of the Big Piney River for April and May are generally four to seven times the magnitude of those occurring in August and September. Most floods occur during the period of February through June, but floods do occur at any time during the year.

There are 19 lakes and reservoirs on the reservation, five of which are utilized for sediment control, eight are for wildlife management and recreation, and the remainder consist of water-filled sinkholes or gravel pits. Some of the reservoirs are old farm ponds which now serve a wildlife management function.

There are numerous fords outside the cantonment area, eleven of which are concrete. Depths should remain less than 0.5 meter (1.5 feet) except in periods of high flooding. Most fords are dry during the summer and all can be crossed with two wheel drive vehicles during low water except those on Roubidoux Creek.

Complete surface water records are available only for Big Piney River. Partial recording and low flow records exist for Roubidoux Creek. The estimates for mean and annual discharge on the Big Piney River were obtained from U.S. Geological Survey Water-Data Report for 1979. Other discharge estimates used in the Drainage Characteristics Table and Estimated Discharges Table are from linear regression equations prepared by Missouri Geological Survey and Water Resources.

No published data are available on streambanks slope, materials, or heights. Generally the bank slopes are near 45 degrees with heights varying from 0.3 to 3 meters (1 to 10 feet) depending upon stream size. Bank material of most streams is silt loam or sandy clay loam. Bottom materials consist primarily of gravel and rock or gravel with small amounts of sand.

DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORY	GENERAL	REGIME	WIDTH	DEPTH	VELOCITY AND DISCHARGE	BANKS	BOTTOM
WATERCOURSES							
Big Piney River	Perennial stream flowing north in a well-defined channel with a broad flood plain. Drains the eastern section of the reservation, discharging into the Gasconade River.	High water March through May; low water September through January; high base flow; flooding can occur any time during year; 100-year flood elevation at water intake pumping station 245m (800 ft) mean sea level; eddy and pool flow at normal flow; ice in pools December through March.	Stream bed at normal flow 45 to 90m (150 to 300 ft); during overbank flooding can reach 550m (1800 ft).	Normal range is 0.8 to 0.9m (2.5 to 3.0 ft); minimum 0.5m (1.6 ft), in September, 1954; maximum 6.3m (20.7 ft), 27 December 1942.	Average velocity 0.9m/sec (3 ft/sec); mean discharge 15m³/sec (540 ft³/sec); minimum discharge recorded 1.95 m³/sec (69 ft³/sec) 17 September 1954 at Big Piney, MO; maximum discharge recorded 926m³/sec (32,700 ft³/sec) 27 December 1942.	Silt loam and sandy clay loam, generally 2.4 to 3.4m (8 to 11 ft) high and steep main channel, reaching 45°. Broad terraced flood plain.	Gravel with sand in pools and slackwater areas; average gradient 1.1m/km (5.6 ft/mi).
Roubidoux Creek Reach 1	Perennial stream flowing north in a well-defined channel in a broad flood plain. Flows into Gasconade River north of reservation. Significant quantities of flow lost to subsurface drainage.	High water March through May; low water September through January; completely dry at times; flooding can occur at any time during year; ice in pools December through March.	Generally over 25m (80 ft) in pools when flowing; bankfull stage 55 to 67m (180 to 220 ft); overbank flooding up to 400m (1300 ft).	Normal range varies from 0 to 1m (3 ft) depending on the season of the year; high water maximum 6m (20 ft).	Minimum discharge is zero; estimated 10-year peak discharge 521m³/sec (18,400 ft³/sec).	Silt loam and sandy clay loam, generally 2.4 to 3.4m (8 to 11 ft) high and steep main channel, reaching 45°. Broad terraced flood plain.	Gravel with sand in pools and slackwater areas; average gradient 1.6m/km (8.4 ft/mi).
Roubidoux Creek Reach 2	Perennial stream flowing north in a well-defined channel in a broad flood plain. Flows into Gasconade River north of reservation.	High water March through May; low water September through January; flooding can occur at any time during year; shoal and pool flow at low water; ice in pools December through March.	Varies from 3 to 40m (10 to 130 ft) during low water; 40m (130 ft) at bankfull stage; overbank flooding up to 300m (1000 ft).	Minimum 1m (3 ft) or less; high water maximum 6.2m (20.3 ft).	Seven-day two-year low flow between .09 to .22m³/sec (3 to 8 ft³/sec); estimated 10-year peak discharge 521m³/sec (18,400 ft³/sec).	Silt loam and sandy clay loam, generally 2.4 to 3.4m (8 to 11 ft) high and steep main channel, reaching 45°. Broad terraced flood plain except near southern reservation boundary which is steep and narrow.	Gravel with sand in pools and slackwater areas; average gradient 1.6m/km (8.4 ft/mi).

B. SURFACE DRAINAGE (Continued)

DRAINAGE CHARACTERISTICS (Continued)

DRAINAGE CATEGORY	GENERAL	REGIME	WIDTH	DEPTH	VELOCITY AND DISCHARGE	BANKS	BOTTOM
WATERCOURSES							
Dry Creek	Intermittent stream flowing north through the cantonment area in a well-defined channel in a terraced flood plain. Drains much of the cantonment area. Flows into Big Piney River north of reservation.	Streamflow occurs mainly from discharge from sewage treatment plant. Stormwater flow occurs in spring snowmelt or during intense or extended rainfall.	Generally 3 to 10m (10 to 32 ft); during overbank flooding up to 100m (330 ft).	Estimated average depth of 10-year flood 1.5 to 2m (5 to 6.5 ft).	Velocities up to 2.7m/sec (9 ft/sec); estimated 10-year peak discharge 59m³/sec (2,100 ft³/sec).	Silt loam and sandy clay loam generally 1.2 to 1.5m (4 to 5 ft) high and steep, reaching 45°.	Gravel with some sand, average gradient 7.6m/km (40 ft/mi).
Musgrave Hollow	Intermittent stream flowing west in a well-defined channel in a wide flood plain. Flows into Roubidoux Creek in the southwest corner of the reservation. Springs maintain a small flow for much of the year.	Most streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall. Small flow during much of the year due to spring flow.	Generally 3 to 10m (10 to 49 ft), near mouth, wide flood plain; upstream narrow flood plain with steep sides; during overbank flooding up to 80m (270 ft).	Estimated average depth of 10-year flood 2.1 to 2.4m (7 to 8 ft).	Velocities up to 2.7m/sec (9 ft/sec); estimated 10-year peak discharge 92m³/sec (3,250 ft³/sec).	Silt loam and sandy clay loam, generally 1.2 to 1.5m (4 to 5 ft) high and reaching 45°.	Gravel with some sand, average gradient 8.7m/km (46 ft/mi).
Smith Branch	Intermittent stream flowing north in a well-defined channel of a steep sided valley. Flows into Roubidoux Creek in the northwest corner of the reservation.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Varies from 3 to 15m (10 to 49 ft), near mouth, wide flood plain; upstream narrow flood plain with steep sides; during overbank flooding up to 80m (270 ft).	Estimated average depth of 10-year flood 2.4m (8 ft).	Velocities up to 2.4m/sec (8 ft/sec); estimated 10-year peak discharge 99m³/sec (3,500 ft³/sec).	Silt loam and sandy clay loam, generally 1.2 to 1.5m (4 to 5 ft) high and reaching 45°.	Gravel with some sand, average gradient 6.6m/km (35 ft/mi).
Hurd Hollow	Intermittent stream flowing northwest in a well-defined channel in a narrow flood plain to Roubidoux Creek.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Generally less than 5m (15 ft); during overbank flooding water may reach 105m (350 ft).	Estimated average depth of 10-year flood 2.4m (8 ft).	Velocities up to 2.4m/sec (8 ft/sec); estimated 10-year peak discharge 70m³/sec (2,480 ft³/sec).	Silt loam and sandy clay loam, generally 1.2m (4 ft) and reaching 45°.	Gravel with some sand, average gradient 6.8m/km (36 ft/mi).
McCourtney Hollow	Intermittent stream flowing east in a well-defined channel in a narrow flood plain. Flows into Big Piney River to the east of the reservation.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Generally 3 to 10m (10 to 32 ft); during overbank flooding water may reach 20m (60 ft).	Estimated average depth of 10-year flood 2m (6.5 ft).	Velocities up to 2.7m/sec (9 ft/sec); estimated 10-year peak discharge 62m³/sec (2,200 ft³/sec).	Silt loam and sandy clay loam, generally 1m (3 ft) and reaching 45°.	Gravel with some sand, average gradient 7.6m/km (40 ft/mi).
Falls Hollow	Intermittent stream flowing east in a well-defined channel in a narrow flood plain to Big Piney River in the southeast corner of the reservation.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Generally 3 to 6m (10 to 20 ft); during overbank flooding 15m (45 ft).	Estimated average depth of 10-year flow 1.8m (6 ft).	Velocities up 3m/sec (10 ft/sec); estimated 10-year peak discharge 44m³/sec (1,570 ft³/sec).	Silt loam and sandy clay loam generally 1m (3 ft) and reaching 45°.	Gravel with some sand, average gradient 11.7m/km (62 ft/mi).
Caby Hollow	Intermittent stream flowing northeast in a well-defined channel in a narrow flood plain to Roubidoux Creek in the southwest corner of the reservation.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Generally 3 to 6m (10 to 20 ft); during overbank flooding 30 to 46m (100 to 150 ft).	Estimated average depth of 10-year flood 1.8m (6 ft).	Velocities up to 2.6m/sec (8 ft/sec); estimated 10-year peak discharge 63m³/sec (2,225 ft³/sec).	Silt loam and sandy clay loam, generally 1m (3 ft) and reaching 45°.	Gravel with some sand, average gradient 7.6m/km (40 ft/mi).
Ballard Hollow	Intermittent stream flowing northwest in a well-defined channel in a narrow flood plain to Roubidoux Creek near northern boundary of the reservation.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Generally 3 to 10m (10 to 20 ft); during overbank flooding width varies greatly from 20m to 60m (70 to 200 ft).	Estimated average depth of 10-year flood 2.1m (7 ft).	Velocities up to 3m/sec (10 ft/sec); estimated 10-year peak discharge 70m³/sec (2,480 ft³/sec).	Silt loam and sandy clay loam, generally 1m (3 ft) and reaching 45°.	Gravel with some sand, average gradient 14.0m/km (72 ft/mi).
Unnamed Stream Grid Reference 819753	Intermittent stream flowing east in a well-defined channel in a narrow flood plain to Big Piney River southeast of the cantonment area.	Streamflow occurs during spring snowmelt and intermittently due to intense or extended rainfall.	Generally 4 to 10m (13 to 32 ft); during overbank flooding 15m (45 ft).	Estimated average depth of 10-year flood 2.4m (8 ft).	Velocities up to 2.7m/sec (9 ft/sec); estimated 10-year peak discharge 59m³/sec (2,100 ft³/sec).	Silt loam and sandy clay loam, generally 1m (3 ft) and reaching 45°.	Gravel with some sand; average gradient 6.0m/km (32 ft/mi).
Other Streams	Ephemeral streams flowing in narrow channels in narrow flood plains.	Streamflow occurs during spring snowmelt or during intense or extended rainfall.	Generally less than 5m (15 ft).	Depths up to 2m (6 ft) during most intense storm.	Velocities relatively high and of short duration; typical peak 10-year discharge less than 28m³/sec (1,000 ft³/sec).	Material varies depending on soil type; silt loam and sandy clay loam predominate; heights vary but usually less than 1.2m (4 ft).	Gravel with some sand, varying gradients usually 7.6m/km (40 ft/mi) or greater, except in cantonment area.

RESERVOIRS

MAP NUMBER	NAME	GRID REFERENCE	APPROXIMATE WATER SURFACE AREA AT CAPACITY		USE	CONSTRUCTION
			hectares	(acres)		
W1	McCann Hollow Pond	705702	0.3	(0.8)	Farm Pond	Earth Dam
W2	Penns Pond	713718	3.6	(8.8)	Wildlife Management and Recreation	Earth Dam
W3	Sed. Pond No. 5	732762	2.1	(5.1)	Sediment Control	Earth Dam
W4	Sed. Pond No. 6	733755	0.7	(1.8)	Sediment Control	Earth Dam
W5	Sed. Pond No. 4	731748	5.0	(12.3)	Sediment Control	Earth Dam
W6	Sed. Pond No. 2	736751	1.6	(4.0)	Sediment Control	Earth Dam
W7	Sed. Pond No. 1	737751	0.8	(1.9)	Sediment Control	Earth Dam
W8	Bloodland Lake	744717	20.2	(50.0)	Wildlife Management and Recreation	Earth Dam, 0.76 x 2.3m (2.5 x 7.5 ft) concrete riser to control normal flow
W9		752679	0.2	(0.5)	Farm Pond	Earth Dam
W10		755765	0.2	(0.6)	Sinkhole Pond	
W11		757765	0.4	(0.9)	Sinkhole Pond	
W12		764788	0.3	(0.8)	Wildlife Management and Recreation	Earth Dam
W13		765728	0.9	(2.3)	Farm Pond	Earth Dam
W14		772747	1.4	(3.5)	Farm Pond	Earth Dam
W15		783724	0.4	(1.0)	Farm Pond	Earth Dam
W16		819750	1.1	(2.7)	Gravel Pit	
W17		826749	0.9	(2.2)	Gravel Pit	
W18		722757	0.2	(0.6)	Sinkhole Pond	
W19		781747	0.4	(1.0)	Gravel Pit	

NOTE: All Earth Dams Have Earthen Emergency Spillways.

ESTIMATED DISCHARGES

MAP NUMBER	GRID REFERENCE	STREAM NAME	DRAINAGE AREA		10-YEAR DISCHARGE		50-YEAR DISCHARGE	
			km²	(mi²)	m³/sec	(ft³/sec)	m³/sec	(ft³/sec)
1	676732	Hurd Hollow	23.6	(9.1)	70	(2480)	132	(4660)
2	702704	McCann Hollow	6.7	(2.6)	39	(1380)	82	(2910)
3	689677	Caby Hollow	18.6	(7.2)	63	(2225)	122	(4325)
4	678645	Caby Hollow	8.0	(3.1)	39	(1370)	77	(2730)
5	698659	Musgrave Hollow	28.5	(11.0)	92	(3250)	185	(6550)
6	744647	Musgrave Hollow	8.8	(3.4)	43	(1510)	86	(3050)
7	717803	Smith Branch	36.5	(14.1)	99	(3500)	192	(6800)
8	726753	Smith Branch	21.0	(8.1)	70	(2470)	136	(4810)
9	735814	Ballard Hollow	15.0	(5.8)	70	(2470)	150	(5300)
10	744794	Pond Hollow	4.1	(1.6)	25	(900)	51	(1790)
11	784832	Dry Creek	12.7	(4.9)	59	(2100)	119	(4200)
12	790805	Dry Creek	5.4	(2.1)	24	(860)	44	(1540)
13	830791	Unnamed Stream	8.3	(3.2)	37	(1300)	71	(2500)
14	787736	Unnamed Stream	8.8	(3.4)	44	(1550)	90	(3185)
15	819752	Unnamed Stream	20.0	(7.7)	59	(2100)	109	(3835)
16	792715	McCourtney Hollow	18.4	(7.1)	62	(2200)	120	(4250)
17	791688	Falls Hollow	7.5	(2.9)	44	(1570)	96	(3400)

B. SURFACE DRAINAGE (Continued)

GAGES

MAP NUMBER	GRID REFERENCE	GAGE NUMBER	DRAINAGE km ²	AREA (mi ²)	PERIOD OF RECORD	TYPE
* G1	838689 675616	06930000 06928300	1450 435	(560) (168)	October 1921 to current 1964-65, 1967, 1969-71	Water stage recorder No data

*Gage outside reservation about 5,000 meters upstream of boundary on Big Piney River.
Symbol on map obscured by sheet index.

LEVEE

MAP NUMBER	GRID REFERENCE	WIDTH AT BASE m (ft)	HEIGHT m (ft)	CONSTRUCTION MATERIAL	USE
L1	820770	16.8 (55)	3 (10)	Rock and earth	Low frequency protection for golf course

DAMS*

MAP NUMBER	GRID REFERENCE	LENGTH m (ft)	HEIGHT m (ft)	USE	CONSTRUCTION
1	810768	53 (175)	2 (6)	Maintains pool for water supply intake	Concrete rubble
2	832792	76 (250)	2 (6)	Maintains pool for old training area	Poured concrete

*Concrete dams. See Reservoir table for earth dam information.

FORDS

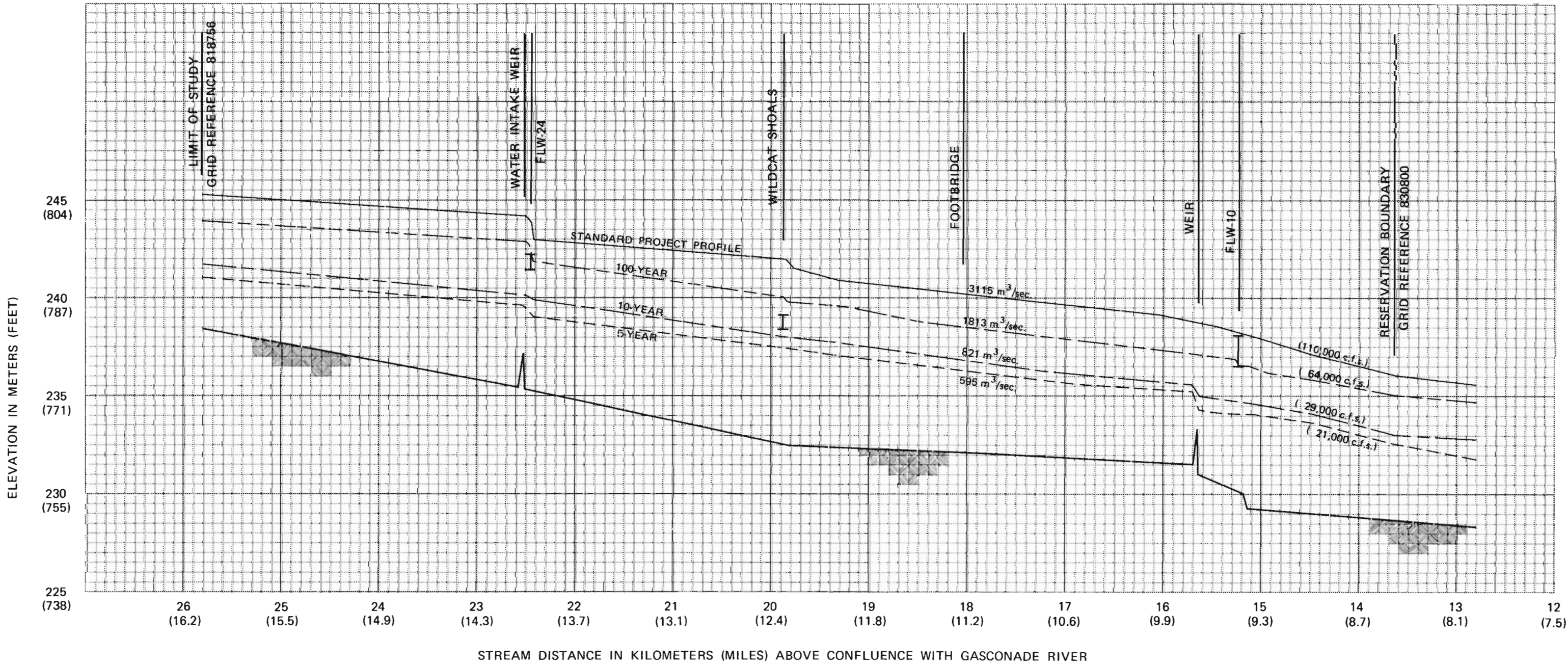
MAP NUMBER	GRID REFERENCE	BOTTOM	DEPTH m (ft)	WIDTH m (ft)	REMARKS*
F1	672642	Gravel	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F2	686664	Concrete Slab with CMP	0.15 (0.5)	6 (20)	All four-wheel drive and tracked vehicles
F3	693710	Gravel	0.15 (0.5)	4.5 (15)	All four-wheel drive and tracked vehicles
F4	693695	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles, Dundas Ford
F5	701675	Concrete Slab with CMP	0.46 (1.5)	18 (60)	Tracked vehicles, Cooksville Ford
F6	694632	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles, Barnard Ford
F7	699652	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles, Blades Ford
F8	698634	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles
F9	703705	Gravel	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F10	703702	Gravel	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F11	718654	Concrete Slab with CMP	0.15 (0.5)	6 (20)	All four-wheel drive and tracked vehicles
F12	728767	Gravel	0.30 (1.0)	12 (40)	All four-wheel drive and tracked vehicles
F13	728755	Gravel	0.30 (1.0)	9 (30)	All four-wheel drive and tracked vehicles
F14	738652	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F15	736812	Gravel	0.46 (1.5)	12 (40)	Tracked vehicles
F16	740802	Gravel	0.46 (1.5)	12 (40)	Tracked vehicles
F17	739801	Gravel	0.46 (1.5)	12 (40)	Tracked vehicles
F18	737798	Gravel	0.46 (1.5)	12 (40)	Tracked vehicles
F19	742796	Gravel	0.46 (1.5)	12 (40)	Tracked vehicles
F20	780738	Concrete Slab	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F21	782735	Gravel	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F22	787736	Concrete Slab	0.15 (0.5)	4.5 (15)	All four-wheel drive and tracked vehicles
F23	792734	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F24	791715	Concrete Slab	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F25	774697	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F26	812792	Gravel	0.15 (0.5)	4.5 (15)	All four-wheel drive and tracked vehicles
F27	783829	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F28	793743	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F29	781822	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F30	717802	Gravel	0.46 (1.5)	12 (40)	All four-wheel drive and tracked vehicles
F31	718806	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles
F32	722807	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles
F33	721779	Gravel	0.30 (1.0)	12 (40)	All four-wheel drive and tracked vehicles
F34	684728	Gravel	0.30 (1.0)	18 (60)	All four-wheel drive and tracked vehicles
F35	689688	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles
F36	689669	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F37	735826	Gravel	0.46 (1.5)	18 (60)	Tracked vehicles
F38	784832	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F39	744737	Concrete Slab	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F40	815748	Gravel	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F41	739738	Concrete Slab with CMP	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F42	787735	Concrete Slab	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles
F43	785824	Concrete Slab with CMP	0.30 (1.0)	6 (20)	All four-wheel drive and tracked vehicles
F44	698684	Concrete Slab	0.15 (0.5)	3 (10)	All four-wheel drive and tracked vehicles

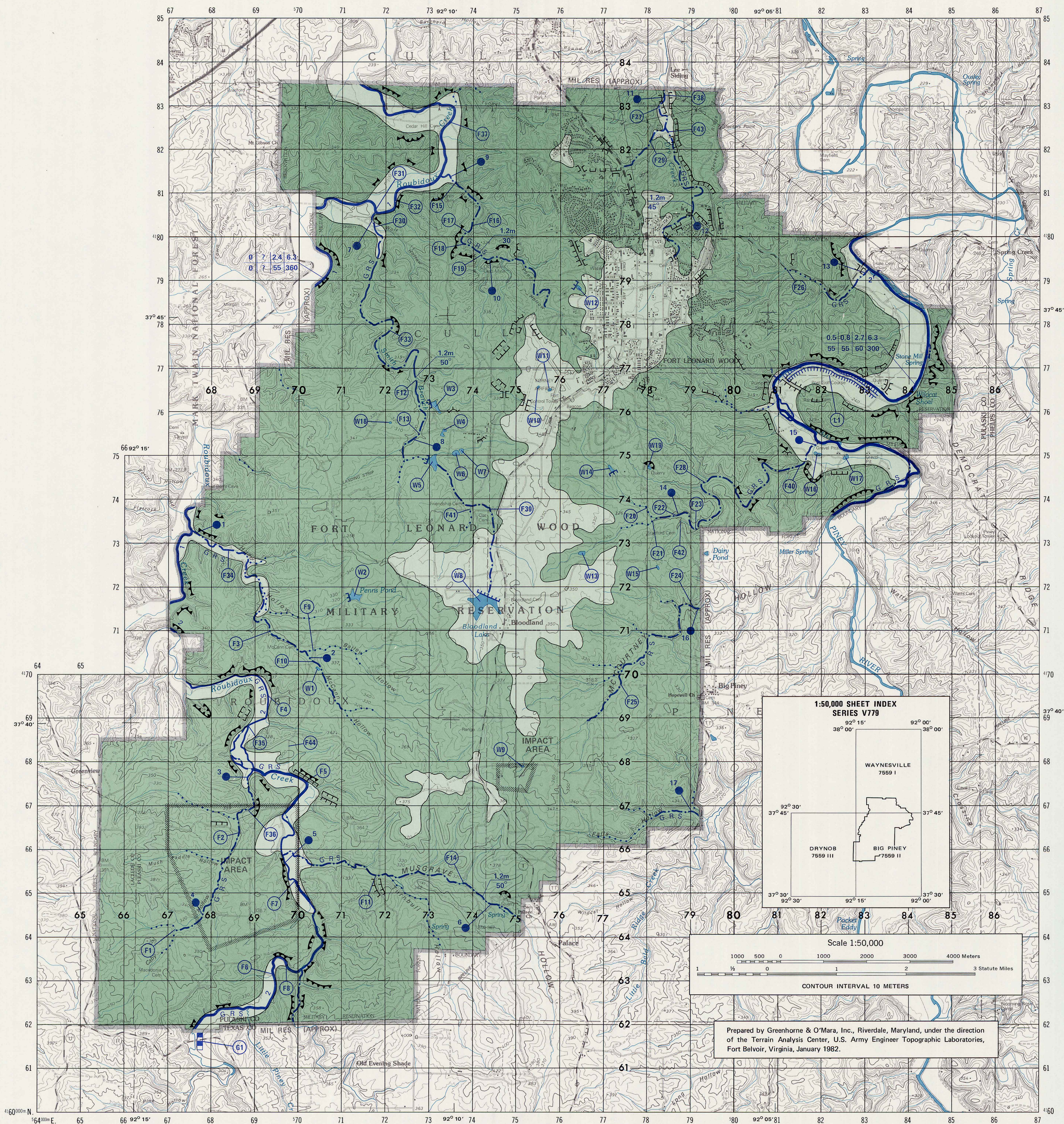
*During periods of low water, all fords except those on Roubidoux Creek can be crossed by two-wheel drive vehicles.



Ford 12 (grid reference 728767) in Smith Branch, following a heavy thunderstorm. Conditions typical of most fords located on the reservation.

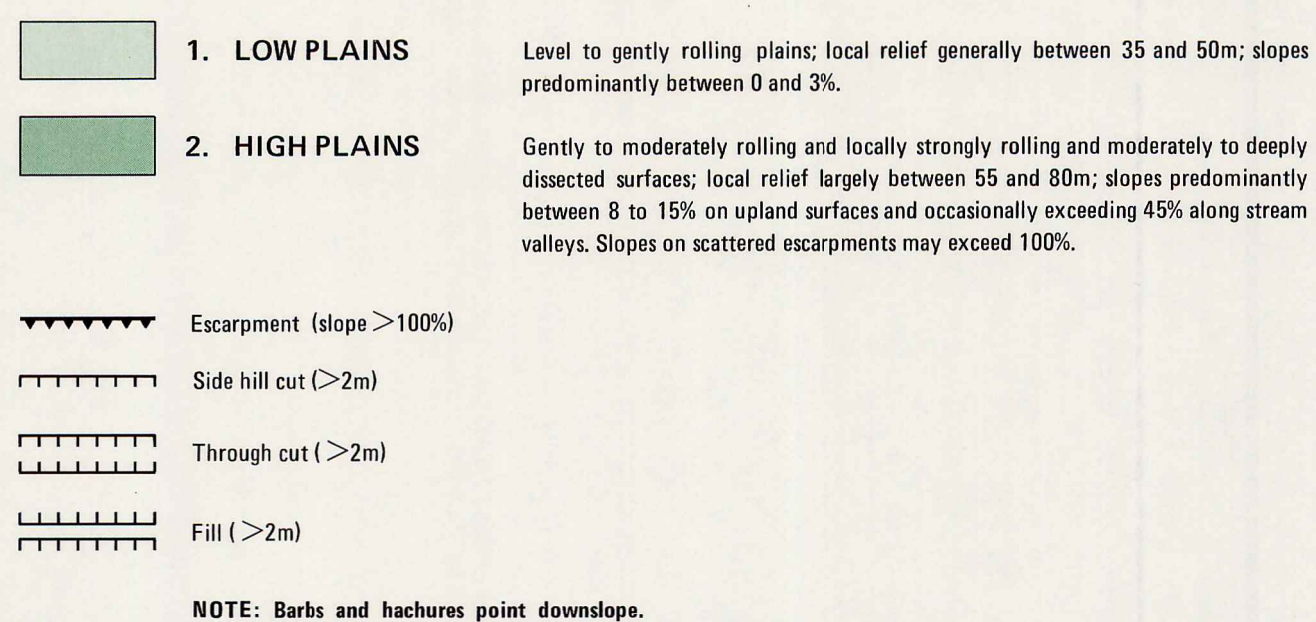
FLOOD PROFILE FOR THE BIG PINEY RIVER



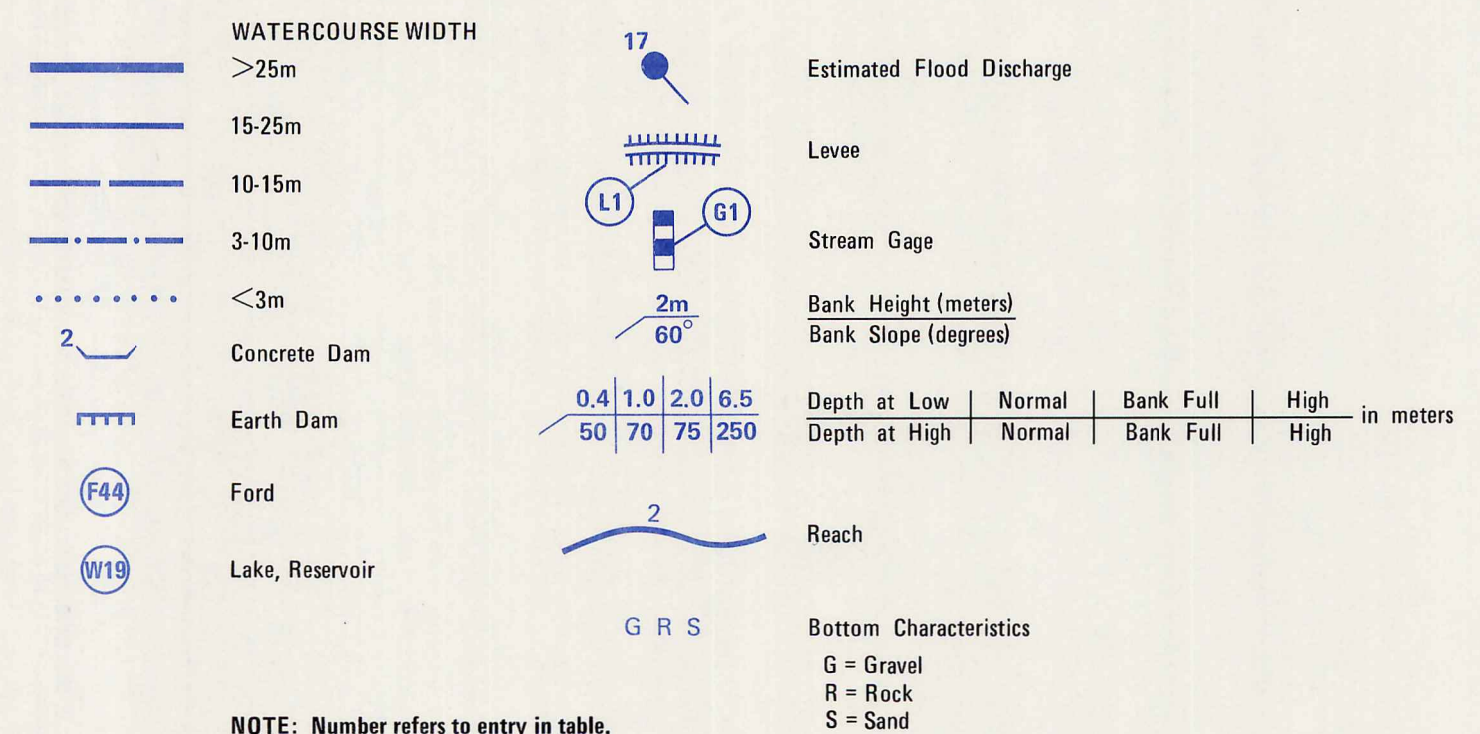


FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

SURFACE CONFIGURATION



SURFACE DRAINAGE



C. WATER RESOURCES

I. SURFACE WATER

Surface water on Fort Leonard Wood is perennially plentiful from the Big Piney River and the southwestern reach of Roubidoux Creek. The Big Piney River provides enormous quantities, even during periods of low flow. Consequently, it is the major source of the reservation water supply. Roubidoux Creek can supply very large quantities of water, but it is not presently used for water supply on the reservation. Tributaries of these two main streams are generally poor sources of fresh water, except during periods of heavy rainfall when larger quantities are available.

The surface water resources categories of Big Piney River and Roubidoux Creek were determined from analysis of 7-day, 10-year low flow records. Surface water categories for other streams on Fort Leonard Wood were evaluated from regional stream flow data.

High water periods in Fort Leonard Wood area streams generally occur in April and May; low water, August through December. With the exception of Big Piney River, stream flows vary widely with greatly increased discharges following rainfall. Roubidoux Creek loses a significant quantity of flow to underground solution channels, resulting in little surface flow for large portions of the year north of grid reference 663700. The table below presents the 7-day low flows at 2-, 10-, 20-, and 50-year recurrence intervals for the Big Piney River and Roubidoux Creek.

Specific information on surface water quality is limited to Big Piney River and Roubidoux Creek. Water quality for Big Piney River is classified by the State of Missouri as Class “A”, the highest quality category. Water quality of Class “A” streams must be maintained to allow whole-body contact recreation such as swimming. A complete water quality assessment of Roubidoux Creek is not available, but a partial analysis by the Missouri Department of Natural Resources indicates it is also Class “A”. Based on regional estimates, surface water quality of other streams on Fort Leonard Wood is generally good. Hardness is higher than desirable but not enough to warrant softening. Turbidity generally increases during periods of high flow. Caution should be exercised when discharging pollutants to streams because underground solution channels may transmit pollutants to other drainage basins at a fairly high rate with little or no chemical change. Potential sources of surface water pollution include effluent from the sewage treatment plant, boiler blowdown wastes, water treatment plant waste water, filter backwash and sludge from mobile water purification units, sediment runoff from training areas 244, 256, and 258, and waste water from sewage lagoons in training areas 244.

The small reservoirs and ponds on Fort Leonard Wood have little appreciable outflow during periods of low water and would be poor water supply sources. Although records are not available, water quality among reservoirs could vary significantly due to runoff carrying sediment, oil and gas residue, and trash. Information on Fort Leonard Wood reservoirs is presented in Section B, Surface Drainage.

MAP UNIT	SOURCE	QUANTITY	QUALITY	DEVELOPMENT OF SOURCES
1	Big Piney River flows northward in a wide channel in a broad flood plain at the eastern boundary of the reservation, approximately 3.0km (1.8 mi) east of the cantonment area. It is the principal water supply for Fort Leonard Wood.	ENORMOUS* quantities are available perennially, averaging 9.2 x 10 ⁵ Lpm (3.5 x 10 ⁸ gpd). Minimum flow of record, 1.2 x 10 ⁵ Lpm (4.5 x 10 ⁷ gpd), occurred 17 and 18 September 1954. Floods and high water increase flow many times, approaching 2.0 x 10 ⁷ Lpm (7.7 x 10 ⁹ gpd) for a two-year event.	Water quality is good, classified as Grade “A” except during heavy rain, in accordance with the Missouri Water Standards as established by the Missouri Clean Water Commission in 1973. Hardness is slightly higher than desirable (207 mg/L compared to the desirable maximum of 150 mg/L), but not enough to warrant softening. Present water treatment includes chemical coagulation, sedimentation, filtration, fluoridation, and disinfection.	Access is fairly good, but is limited by high stream flow velocities and inundation of adjacent flood plain to a depth of 6.1m (20 ft) during floods. Two pools formed by low dams could be used as intake areas. At present, only the pool south of the golf course (grid reference 767809) is utilized as an intake area and pumped to the water treatment plant. Minimum flow is large enough to supply four times the projected maximum daily water requirement for the reservation water system.
2	Roubidoux Creek (upper reach) flows northward in a wide channel in a broad flood plain crossing the southwestern corner of the reservation.	VERY LARGE quantities are available perennially. Perennially plentiful flow decreases to zero at grid reference 663700, 8.0km (5.0 mi) north of the southern reservation boundary due to loss to underground flow. Fluctuations in streamflow are large, with high flows approaching 8.4 x 10 ⁶ Lpm (3.2 x 10 ⁷ gpd) for a two-year event.	Water quality is good, classified as Grade “A” except during heavy rain, in accordance with the Missouri Water Standards as established by the Missouri Clean Water Commission in 1973. Hardness is slightly higher than desirable (185 mg/L compared to desirable maximum of 150 mg/L), but not enough to warrant softening. Extensive water quality data are not available.	Access is limited by steep banks and a broad flood plain inundated to depths exceeding 6.1m (20 ft) and subject to high streamflow velocities during floods. Impoundments are probably infeasible due to the highly fractured stream bed.
3	Roubidoux Creek (lower reach) flows northward in a wide channel in a broad flood plain, crossing the northwestern corner of the reservation.	VERY LARGE quantities of water are available seasonally from grid reference 663700 to the northern reservation boundary. Fluctuations in stream flow are large, with high flows approaching 8.4 x 10 ⁶ Lpm (3.2 x 10 ⁷ gpd) for a two-year event. Completely dry at times, especially during September through January.	Water quality is good, classified as Grade “A” except during heavy rain, in accordance with the Missouri Water Standards as established by the Missouri Clean Water Commission in 1973. Hardness is slightly higher than desirable (185 mg/L compared to desirable maximum of 150 mg/L), but not enough to warrant softening. Extensive water quality data are not available.	Access is limited by steep banks and a broad flood plain inundated to depths exceeding 6.1m (20 ft) and subject to high streamflow velocities during floods. Due to the nature of the stream, water may be available only in certain reaches the entire year. Impoundments are probably infeasible due to the highly fractured stream bed.
4	The stream in Musgrave Hollow flows west to Roubidoux Creek in a narrow channel within a wide flood plain at the southern boundary of the reservation, approximately 10km (6.25 mi) from the cantonment area.	LARGE quantities are generally available throughout much of the year due to flow from springs. Fluctuations in streamflow are large, with high flows of nearly 1.6 x 10 ⁶ Lpm (5.9 x 10 ⁷ gpd) for a two-year event.	Water quality is good, based on regional estimates, although hardness is slightly higher than the desirable maximum of 150 mg/L.	Accessibility in some areas is limited by steep terrain and dense vegetation. Fractures and fissures common in the rock strata in the region may hamper impoundment development.
5	Dry Creek flows northeast to Big Piney River in a narrow channel within a narrow flood plain in the northern portion of the cantonment area.	MEAGER quantities are available in upper reaches most of the year. Flow in the lower reach is composed almost totally of sewage effluent for large portions of the year. Fluctuations in streamflow along the entire course are large with high flows reaching 0.84 x 10 ⁵ Lpm (3.18 x 10 ⁷ gpd) for a two-year event.	No records are available, but sewage treatment plant effluent significantly degrades quality in the reach below the plant. Natural stream purification processes do occur; organic and nutrient concentrations significantly decrease from the effluent discharge point to a point near the confluence with Big Piney River. In the reach above the plant, water quality is good, based on regional estimates, although hardness is slightly higher than the desirable maximum of 150 mg/L.	Accessibility is good, but the intermittent nature of the stream restricts its use as a year-round supply. The reach below sewage treatment plant is unusable for potable water due to poor water quality. Fractures and fissures common in the rock strata in the region may hamper impoundment development.
	Other intermittent streams. Data are not available, and only representative streams are shown and categorized on the map. Stream valleys range from broad, gently sloping to narrow, bounded by steep valley walls.	MEAGER quantities are periodically available most of the year. Rapid runoff can produce LARGE yields for brief periods following heavy rainfall. Smaller streams flow for less than a day; larger streams may flow a week or longer.	Water quality is good, based on regional estimates, although hardness is slightly higher than the desirable maximum of 150 mg/L. Sediment load increases during high water.	Accessibility is limited by steep terrain and dense vegetation. Fractures and fissures common in the rock strata in the region may hamper impoundment development.

*Definition of terms in bold print

Quantity	Liters Per Minute (Lpm)	Gallons Per Day (gpd)
ENORMOUS	>40,000	>15,000,000
VERY LARGE	4000 - 40,000	1,500,000-15,000,000
LARGE	400 - 4000	150,000-1,500,000
MEAGER	<4	<1500

7-DAY LOW FLOWS

STREAM AND LOCATION	DRAINAGE AREA		ANNUAL LOW-FLOW FOR INDICATED RECURRENCE INTERVAL							
			2-YEAR		10-YEAR		20-YEAR		50-YEAR	
			m ³ /sec [Lpm]	(ft ³ /sec) [gpd]	m ³ /sec [Lpm]	(ft ³ /sec) [gpd]	m ³ /sec [Lpm]	(ft ³ /sec) [gpd]	m ³ /sec [Lpm]	(ft ³ /sec) [gpd]
	km ²	(mi ²)								
Big Piney River at Big Piney Village	1450	(560)	3.25 [1.9 x 10 ⁵]	(115) [7.4 x 10 ⁷]	2.32 [1.4 x 10 ⁵]	(82) [5.3 x 10 ⁷]	2.12 [1.3 x 10 ⁵]	(75) [4.8 x 10 ⁷]	1.93 [1.2 x 10 ⁵]	(68) [4.4 x 10 ⁷]
Roubidoux Creek at Reservation Southern Boundary	435	(168)	0.13 [7.6 x 10 ³]	(4.5) [2.9 x 10 ⁵]	0.04 [2.5 x 10 ³]	(1.5) [9.7 x 10 ⁵]	No Data		No Data	
Roubidoux Creek at Reservation Northern Boundary	699	(270)	0	(0)	0	(0)	No Data		No Data	

NOTE: For gage location and period of record, see Section B, Surface Drainage.

C. WATER RESOURCES (Continued)

SURFACE WATER (Continued)

QUALITY OF SURFACE WATER				
BIG PINEY RIVER AT TREATMENT PLANT			ROUBIDOUX CREEK AT WAYNESVILLE	
SOURCE DATA				
Grid Reference	809768			
Sample Number on Accompanying Map	1			*
Date of Analyses	1966-1976		1969-1974	
Drainage Area km ² (mi ²)	1450 (560)		764 (295)	
	MEAN	RANGE	MEAN	RANGE
Temperature °C (°F)	14.0 (57.0)	1-28 (33-82)	**	
pH, units	7.9	7.4-8.1		7.1-8.1
Specific Conductance micromhos/cm	315.0		327.0	176-420
Color, units	1.0	0-8		
Turbidity, JTU	20.0	10-400	28.0	10-125
Fecal coliform (colonies/100 ml)	110.0	10-1300	586.0	10-9500
Gross Alpha Particle Activity (picocuries/liter)	1.1			
Gross Beta Particle Activity (picocuries/liter)	2.3			
Tritium (microcuries/liter)	0.0255			
Strontium 90 (picocuries/liter)	0.0			
Radium 226 (picocuries/liter)	0.0			
Dissolved Oxygen (mg/L)	9.3	7.6-12.8	9.1	6.3-13
Chemical Oxygen Demand (mg/L)	5.0	1-12	5.0	1-10
CONSTITUENTS (mg/L unless otherwise noted)				
Dissolved Solids	184.0	134-228		
Calcium	42.0	30-56		
Magnesium	25.0	19-35		
Sodium	2.0			
Potassium	1.0			
Sulfate	26.0	13-40	10.0	6-14
Chloride	8.0	7-10		
Fluoride	0.0		0.2	0.1-0.9
Silica	8.9			
Nitrate	0.0			
Total Phosphorus	0.06	0.02-0.13	0.35	0.02-2.51
Dissolved Phosphorus	0.02	0.02-0.07	0.11	0.02-0.29
Arsenic	0.02			
Barium	0.3			
Boron	0.0			
Cadmium	0.005			
Chromium	0.025			
Copper	0.025			
Iron	0.05	Trace 0.1		
Lead	0.005			
Manganese	0.09			
Mercury	0.0002			
Silver	0.025			
Zinc	0.015			
Hardness, total as CaCO ₃	207.0	161-270	185.0	144-280
Alkalinity as CaCO ₃	135.0	46-176	166.0	110-224
Endrin (micrograms/liter)	0.1			*
Lindane (micrograms/liter)	0.1			
Methoxyclor (micrograms/liter)	0.4			
Toxaphene (micrograms/liter)	0.0			
*Recording station location does not appear on base map.				
**Blank spaces indicate data not available.				



Roubidoux Creek during normal flow in the perennial upper reach (grid reference 694632) can supply very large quantities of fresh water throughout the year.



Big Piney River, the major source of water for the reservation, at the water intake (grid reference 810768) during high water. Note the concrete rubble weir (Dam No. 1) and pumping station.

2. GROUND WATER

Ground water is plentiful on Fort Leonard Wood. Aquifer recharge is sufficient and the underlying geologic formations are well suited to ground water movement.

The ground water supply for the post is obtained from five wells. Three of the wells, the Lieber Heights Well #1, the Ammo Dump Well, and the well at Training Area 256, can supply large quantities of ground water. Moderate quantities of ground water are available at the Golf Course and Pump Station Wells.

Numerous springs emanate from the Gasconade Formation (dolomite) along the Big Piney River and Roubidoux Creek. Stone Mill Spring, which is currently used for recreation, can supply very large quantities of ground water.

Four aquifers underlying the reservation are the sources of ground water. Regionally, the aquifers dip slightly to the northwest; however, ground water movement at Fort Leonard Wood is generally north to northeast because of local lithology and structure. As is common with dolomite aquifers, availability and transmissibility of ground water is proportional to the number of interconnected cavities, and to the thickness of the aquifer. Yields approaching 1514 liters per minute (400 gallons per minute) are obtained from the Potosi Formation, a deep coarsely crystalline dolomite with abundant interconnected small cavities. Lesser yields with a maximum of 151 liters per minute (40 gallons per minute) are obtained from the Gunter Member of the Gasconade Formation, a

deep formation composed of a sandstone grading to sandy dolomite. The remainder of the Gasconade Formation is composed of chert and dolomite. The Eminence Formation, a medium to coarsely crystalline dolomite with abundant chert, has the most highly variable yields of the four formations, and in some locations on the reservation may be a poor source of water.

Ground water from all sources tends to be slightly harder than normal, but not enough to warrant softening. Chlorination is the only type of treatment usually required. Care should be exercised, however, in development of a source because most aquifers in this area transmit water through open subsurface channels that have few filtering properties. The Missouri Department of Community Affairs has designated the region as one of high susceptibility for ground water pollution.

The Missouri Department of Natural Resources provided all the information concerning well depths and approximate yields. Water quality analyses were provided by the United States Army Environmental Hygiene Agency and the United States Geological Survey. Regional estimates of yield were obtained from both the United States Geological Survey and the Missouri Department of Natural Resources. Geologic information was provided by the Missouri Department of Natural Resources.

C. WATER RESOURCES (Continued)

2. GROUND WATER (Continued)

MAP UNIT	QUANTITY AND SOURCE	DEPTH	QUALITY	DEVELOPMENT OF SOURCES												
1	<p>LARGE* quantities of fresh water are available from wells extending to a depth of 305m (1000 ft) or deeper and intersecting the Potosi Formation, a coarsely crystalline dolomite with abundant interconnected small cavities or vugs which enable water to flow freely. Lithologic character and wide outcrop area make it a dependable aquifer varying significantly only in response to long periods of excessively dry weather. Most wells yield between 1135-1515 Lpm (300-400 gpm). In the vicinity of the reservation, the thickness of this horizontally bedded formation is approximately 80m (262 ft). The Potosi Formation is overlain by the Eminence Formation and underlain by the Elvins Group, a confining formation.</p>	<p>Regionally, all strata dip slightly to the northwest; slight local variations may affect the elevation of any formation by as much as 15m (50 ft). The figure on the following page indicates the positions of the strata and approximate yields. The Potosi Formation occurs between mean sea level to 115m (377 ft) above mean sea level. The formation is 215m (705 ft) below the surface in the cantonment area and 135m (442 ft) below the surface near Roubidoux Creek and Big Piney River. Lieber Heights Well # 1 and Training Area 256 Well intersect the Potosi Formation.</p>	<p>Water is generally suitable for human consumption. Chemical analyses show the water to be slightly harder than normal. Hardness of water from wells tested on the reservation ranges from 165.9 mg/L to 212.8 mg/L. Hardness generally becomes noticeable if CaCO₃ is greater than 150 mg/L and excessive if more than 300 mg/L. The pH of raw ground water from wells ranges from 7.8 to 7.9. Concentrations of dissolved solids range from 185.7 mg/L to 228.3 mg/L. Present treatment of water at Lieber Heights Well #1 and the Training Area 256 Well is limited to chlorination.</p> <p>Analyses are from information provided by the United States Environmental Hygiene Agency, United States Geological Survey, and the Missouri Department of Natural Resources. Chemical analyses of the ground water are presented in the table on the page following.</p>	<p>Wells should be drilled with air rotary drills to mean sea level and spaced no closer than 457m (1500 ft) for maximum yield. The best yields would be from wells which penetrate joints and solution channel openings. To reduce chance of contamination, the upper part of the geologic section, which is highly permeable in some areas, should be cased off and sealed. Access to most sites would be relatively easy through existing roads. Positioning of the drill rig should not pose a problem except on the steep slopes near stream valleys.</p> <p>The dolomite aquifers have little or no natural filtering properties because water is transmitted through solution channels. Consequently, in development of a new source, care should be exercised since the water may be polluted. At a minimum, ground water should be chlorinated to eliminate possible bacterial contamination.</p> <p>Currently Lieber Heights Well # 1 is the only well which is part of the water distribution system for the reservation. The well supplements the system whose major source is treated surface water from Big Piney River.</p>												
	<p>MODERATE quantities of fresh water are available from wells extending to a depth of 200m (656 ft) and intersecting the Eminence Formation which is medium to coarsely crystalline dolomite with abundant chert and locally very siliceous. Yield of ground water varies widely with some locations yielding up to 1135 Lpm (300 gpm), but most averaging 57 Lpm (15 gpm). In the vicinity of the reservation, the thickness of this horizontally bedded formation is approximately 85m (279 ft). The overlying formation is the Gunter Member of the Gasconade Formtion.</p>	<p>The Eminence Formation occurs between 115m (377 ft) and 200m (656 ft) above mean sea level. The formation is 130m (426 ft) below the surface in the cantonment area and 50m (164 ft) below the surface near Big Piney River and Roubidoux Creek. The Pump Station Well intersects this formation.</p>														
	<p>MODERATE quantities of fresh water are available from wells extending to a depth of 100m (328 ft) and intersecting the Gunter Member at the base of the Gasconade Formation. The Gunter Member is sandstone grading to sandy dolomite; in the area of the reservation it is 20 to 40 percent sand. Most wells yield 150 Lpm (40 gpm). In the vicinity of the reservation, the thickness of this horizontally bedded formation is approximately 4.5m (15 ft). The Gunter Member is overlain by the upper section of the Gasconade Formation.</p>	<p>The Gunter Member at the base of the Gasconade Formation occurs about 200m (656 ft) above mean sea level. The formation is 125m (410 ft) below the surface in the cantonment area and 45m (147 ft) below the surface near Roubidoux Creek and Big Piney River.</p>														
	<p>MODERATE quantities of fresh water are available from wells extending to a depth of 95m (311 ft) and intersecting the upper section of the Gasconade Formation. The upper 15 to 23m (50 to 75 ft) of the formation is dense, finely crystalline dolomite which provides a good seal for the water-bearing zone below it. The chert and dolomite lower portion of the formation is a good aquifer. Most wells yield 57 Lpm (15 gpm). In the vicinity of the reservation, the thickness of this horizontally bedded formation is approximately 65m (213 ft). The overlying formation is the Roubidoux Formation which is not an aquifer on the reservation, but is an aquifer in areas to the northwest of the reservation where it is extensively overlain by the Jefferson City Formation (dolomite).</p>	<p>The upper section of the Gasconade Formation occurs between 205m (673 ft) and 300m (984 ft) above mean sea level. The formation is 30m (98 ft) below the surface in the cantonment area and is exposed in the valley walls on either side of Roubidoux Creek and Big Piney River.</p>														
	<p>Springs are numerous, flowing along solution channels in the Gasconade Formation. Quantities are known for Stone Mill Spring (grid reference 845772) at the eastern boundary of the reservation. VERY LARGE quantities are available, based on 7-day, 10-year low flow. For a 41-year period of record from 1925 to 1966, the maximum discharge was 90,058 Lpm (23,793 gpm) 3 June 1966, and the minimum discharge was 28,886 Lpm (7632 gpm) on 2 August 1934. Stone Mill Spring is currently used for recreation.</p>															
	<p>Recharge to the ground-water-bearing strata is from precipitation and surface streams. Recharge is extremely rapid after rainfall with noticeable increases appearing in less than a day. Diversion or damming of ground water by cross-cutting geologic structures does not appear to be a problem. Ground water flow velocities vary significantly in the region depending on the number and size of the fractures and interconnected solution channels. Roubidoux Creek has an underground water velocity of 2.3m/min (7.7 ft/min), and Dry Creek has an underground velocity of 0.2m/min (0.7 ft/min), both measured by the Missouri Department of Natural Resources.</p>	<p>For depths and yields of specific wells see table "Wells", below.</p>														
<p>*Definition of terms in bold print:</p> <table><tr><th>Quantity</th><th>Liters Per Minute (Lpm)</th><th>Gallons Per Day (gpd)</th></tr><tr><td>VERY LARGE</td><td>4000 - 40,000</td><td>1,500,000-15,000,000</td></tr><tr><td>LARGE</td><td>400 - 4000</td><td>150,000-1,500,000</td></tr><tr><td>MODERATE</td><td>40 - 400</td><td>15,000-150,000</td></tr></table>					Quantity	Liters Per Minute (Lpm)	Gallons Per Day (gpd)	VERY LARGE	4000 - 40,000	1,500,000-15,000,000	LARGE	400 - 4000	150,000-1,500,000	MODERATE	40 - 400	15,000-150,000
Quantity	Liters Per Minute (Lpm)	Gallons Per Day (gpd)														
VERY LARGE	4000 - 40,000	1,500,000-15,000,000														
LARGE	400 - 4000	150,000-1,500,000														
MODERATE	40 - 400	15,000-150,000														

WELLS

NAME	Lieber Heights Well # 1	Pump Station Well	Golf Course Well	Training Area 256 Well	Ammo Dump Well
GRID REFERENCE	758811	809767	819764	814752	781750
MAP IDENTIFICATION	1	2	3	4	5
APPROXIMATE SURFACE ELEVATION	344m (1127 ft)	244m (800 ft)	261m (857 ft)	245m (803 ft)	336m (1102 ft)
DEPTH OF WELL	312m (1025 ft)	46m (150 ft)	No Data	216m (710 ft)	No Data
APPROXIMATE CASING DEPTH	137m (450 ft)	46m (150 ft)	No Data	61m (200 ft)	No Data
APPROXIMATE YIELD	1136 Lpm (300 gpm)	189 Lpm (50 gpm)	379 Lpm (100 gpm)	568 Lpm (150 gpm)	946 Lpm (250 gpm)

C. WATER RESOURCES (Continued)

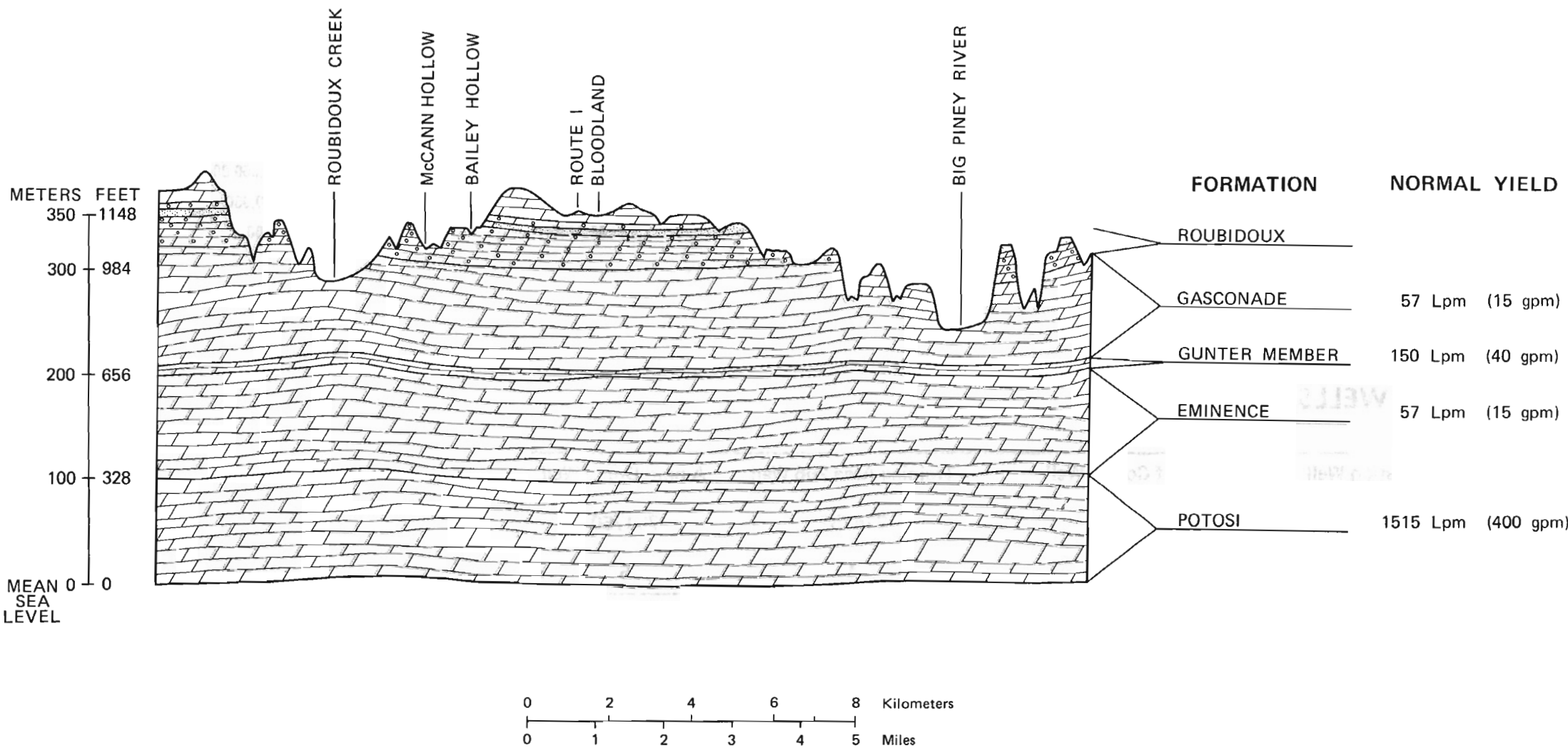
2. GROUND WATER (Continued)

7-DAY LOW FLOWS

SPRING	GRID REFERENCE	ANNUAL LOW FLOW FOR INDICATED RECURRENCE INTERVAL			
		2 YEAR		10 YEAR	
		m ³ /sec [Lpm]	(ft ³ /sec) [gpd]	m ³ /sec [Lpm]	(ft ³ /sec) [gpd]
Stone Mill Spring	845772	0.6 [3.6 x 10 ⁴]	(20.0) [1.3 x 10 ⁷]	0.5 [3.0 x 10 ⁴]	(16.0) [1.0 x 10 ⁷]

QUALITY OF GROUND WATER

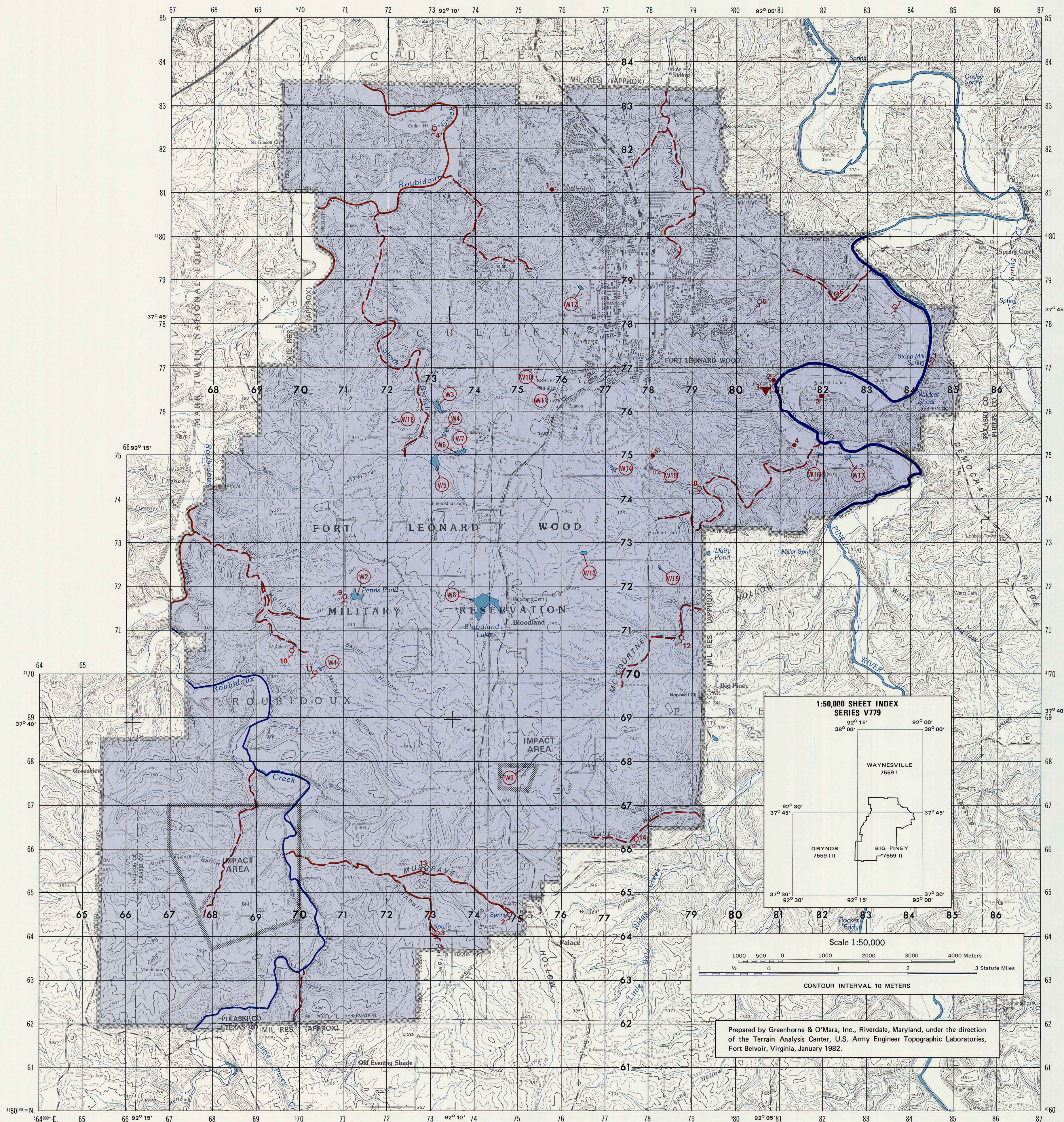
SOURCE DATA	Lieber Heights Well # 1	Golf Course Well	Training Area 256 Well	Area Wells > 305m (> 1000 ft.) Deep	Stone Mill Spring	Stone Mill Spring
Source						
Grid Reference	758811	819764	814752		845772	845772
Number on Accompanying Map	1	3	4		1	1
Date of Analysis	July 1975	July 1975	July 1975		August 1965	September 1925
Temperature °C (°F)					14.0 (58.0)	
pH	7.8	7.9	7.9	7.8	8.2	
Specific Conductance (micromhos/cm)	427.0	407.0	325.0	355.0	300.0	
Color	4.0	5.0	10.3	2.0		
Gross Alpha Particle Activity (picocuries/liter)	1.1	1.0	1.3			
Gross Beta Particle Activity (picocuries/liter)	1.2	9.2	1.5			
Tritium	0.0669	0.0337	0.0005			
CONSTITUENTS (mg/L)						
Total Dissolved Solids	228.3	225.0	185.7	217.0	180.0	201.0
Calcium	83.8	46.8	41.2	54.0	34.0	40.0
Magnesium	25.2	20.3	18.9	32.0		
Sodium	2.1	2.8	2.5	2.0		
Potassium	1.11	0.98	1.70	1.0		
Sulfate	5.4	3.6	5.0	10.0	3.3	2.3
Chloride	2.1	6.3	1.9	5.0	2.7	3.2
Fluoride	0.20	0.1	0.1	0.3		
Silica	7.0	11.4	6.3	1.0	2.6	6.4
Nitrate	0.1	1.7	0.1	0.0	0.7	2.4
Arsenic	0.025	0.027	0.020	0.02		
Barium	0.30	0.30	0.30	0.3		
Boron	0.70	0.10	0.09			
Cadmium	0.007	0.003	0.003	0.005		
Chromium	0.025	0.025	0.025	0.025		
Copper	0.275	0.025	0.026			
Iron	0.2	0.3	0.2	0.1	0.12	0.31
Lead	0.010	0.008	0.008	0.2		
Manganese	0.03	0.04	0.05	0.0	20.0	22.0
Mercury	0.0002	0.0003	0.0003	0.0002		
Selenium	0.000	0.000	0.000			
Silver	0.025	0.015	0.017	0.025		
Zinc	0.023	0.413	0.017	0.03		
Hardness, total as CaCO ₃	212.8	211.9	165.9	302.0	168.0	188.0
Alkalinity as CaCO ₃	195.9	198.4	154.0	164.0		



WATER-BEARING STRATA AND NORMAL YIELDS



Stone Mill Spring (grid reference 845772) as it issues from the Gasconade Formation during a period of high flow.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

WATER RESOURCES

SURFACE WATER

FRESH WATER PERENNIALY PLENTIFUL

1. **ENORMOUS*** quantities available from Big Piney River.
2. **VERY LARGE** quantities available from upper reach of Roubidoux Creek; quantities increase during periods of high water, usually April and May.

FRESH WATER SEASONALLY PLENTIFUL

3. **VERY LARGE** quantities available from lower reach of Roubidoux Creek; quantities increase during periods of high water, usually April and May.
4. **LARGE** quantities available from Musgrave Hollow due to flow from springs; quantities increase during periods of high water, usually April and May.

FRESH WATER SCARCE

5. **MEAGER** quantities available from Dry Creek and periodically from other intermittent tributary streams. Quantities increase during brief periods of high water.

- ▼¹ Location of sample for quality of water analysis.
- W19 Reservoirs (see Section B, **SURFACE DRAINAGE**, for data).

*Definition of terms in bold print

Quantity	Liters Per Minute (Lpm)	Gallons Per Day (gpd)
ENORMOUS	>40,000	>15,000,000
VERY LARGE	4000 - 40,000	1,500,000-15,000,000
LARGE	400 - 4000	150,000-1,500,000
MODERATE	40 - 400	15,000-150,000
MEAGER	<4	<1500

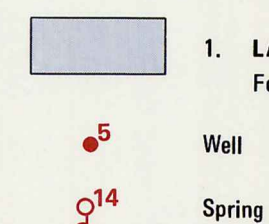
NOTES: Number refers to entry in table.

For permissible concentrations of impurities in military water supplies, see U.S. Department of the Army Technical Manual TM 5-700, Field Water Supply, July 1967, paragraph 19, or other applicable manuals or regulations.

GROUND WATER

FRESH WATER GENERALLY PLENTIFUL

1. **LARGE*** quantities of fresh water available from deep (>305m (1000 ft)) wells in the Potosi Formation (dolomite).



NOTE: **MODERATE** quantities of fresh water available at lesser depths from wells intersecting the Gasconade and Eminence Formations (see cross-section "Water-Bearing Strata and Normal Yields", previous page).

D. ENGINEERING SOILS

A generalized pattern of soils that occur on the Fort Leonard Wood reservation is outlined in the table below and on the accompanying map. The table describes the prevalent physical, hydrologic, and engineering characteristics of the soils, particularly as they pertain to general planning. This information provides a means of comparing the key physical characteristics of various soil units on the reservation and gives a preliminary assessment of their suitability and/or limitations as they relate to future development. It is intended as a general guide, and should not be considered a substitute for detailed site investigation.

The map is derived from a medium scale (1:250,000) general soils map of Pulaski County provided by the U.S. Department of Agriculture, Soil Conservation Service. With minor modifications using aerial photography, it was enlarged to 1:50,000. The four map units depicted represent approximate boundaries of soil associations groupings, including seven specific soils groups. In two cases, a specific soil (i.e., Lebanon and Clarksville) is duplicated between two groupings by reason of association. Each grouping represents an association of two or three soils normally occurring under a given set of environmental circumstances (e.g., parent material, landform and slope, and drainage characteristics). Specific locations of individual soil types will be available after a detailed soil survey of Pulaski County, including Fort Leonard Wood, is completed by the Soil Conservation Service in 1982.

Map Unit 1 consists of broad, gently sloping ridgetops and plateaus dropping off to steep hillsides, and covers about 55 percent of the reservation. It includes Lebanon, Viraton, and Clarksville soils that are formed in cherty residuum and loess over cherty residuum. They are moderately well drained to excessively well drained, but fragipan in the gently sloping areas reduces percolation.

Map Unit 2, Lebanon and Gatewood variant soils, is for the most part on nearly level to moderately sloping low plains and strongly sloping to steeply sloping sideslopes of the high plains. This unit covers about 20 percent of Fort Leonard Wood. Fragipan is common on ridges and plateaus.

Map Unit 3 consists of Clarksville, Claiborne, and Doniphan soils on narrow ridgetops and convex sideslopes and footslopes in the high plains. The ridges are irregular in shape and the slopes are dissected by intermittent streams. The soils are gently sloping to steep, well drained to somewhat excessively drained, and are derived from weathered cherty residuum or colluvium. This unit covers about 20 percent of the reservation.

Map Unit 4, the Huntington soil, covers the remaining 5 percent of the reservation. It consists of nearly level to gently sloping, well drained to poorly drained, deep alluvial soils on flood plains and terraces along the major streams.

The soil profiles exemplified in the table are highly generalized and represent "average" typical profiles that can be expected for each map unit, and make allowances for the commonly occurring lateral variations in texture.

Actual conditions may vary markedly because of the nature of the soil, a result of lithologic gradations in the parent material and differential weathering. Local variations in clay, sand, and gravel content and layering are remarkable. Additionally, the depth of the soil and condition of the bedrock surface are highly irregular. Each of the seven soil units is evaluated in terms of its limitations (slight, moderate, severe) for six common engineering applications, including the major constraints such as slope, rapid percolation, etc., which would limit its use for development. All of the soils on the reservation exhibit either moderate or severe limitations for most engineering applications evaluated. These limitations are due in general to the high water table in the uplands soils and excessive slope elsewhere. More specific data on areal limitations can be determined after completion of the detailed soil survey being performed by the Soil Conservation Service.

The soils of Fort Leonard Wood consist primarily of residual soils formed on interbedded dolomite and sandstone, and a limited area of relatively young alluvial deposits that have developed on unconsolidated stream-deposited parent material. The alluvial materials, composed of gravel, sand, silt and clay, are located along the flood plains of the Big Piney River in the northeast and Roubidoux Creek in the southwest and northwest portions of the reservation. The residual soils which occur on the greater part of the reservation are chiefly cherty clays, sandy clays, and clay and silt loams of low organic content derived mainly from the thick beds of cherty dolomites which dominate the bedrock of the area.

Most of the soils in the low plains are very deep, sometimes exceeding 20 meters (65 feet), and commonly have a fragipan horizon which restricts water percolation and root penetration. Because the bedrock is very susceptible to solution weathering, subsurface erosion and slump may produce cavernous openings in the residual soil overburden with no surface evidence of their existence. A deep void may be concealed by a relatively thin (e.g., 2 to 3 meters, 6 to 10 feet) unsupported soil layer. Building construction in these areas should be preceded by closely spaced borings to sufficient depth to insure a firmly supported foundation. In the southern part of the reservation, soils which have developed on the Jefferson City dolomite above the resistant "Quarry Ledge" (elevations 350-360 meters, 1150 -1180 feet) may be shallow, normally less than 3 meters (10 feet) thick.

Soils on the slopes generally have a thin surface layer of dark cherty silt loam over a very cherty silty clay loam subsurface layer which continues downward through the subsoil.

Flood plain soils have developed on riverine sands eroded from the adjacent uplands, and consist of several feet of very sandy gravelly silt with relatively high organic content. The soil is very permeable, with a water table 1.2 to 1.8 meters (4 to 6 feet) below the surface. On either side of the flood plain, colluvial soils eroded from the adjacent hills form gentle slopes toward the streams. These relatively impermeable soils consist of silty sandy stoney clays, and rise to as much as 9 meters (30 feet) above the general flood plain.

MAP UNIT	MAJOR SOIL SERIES*	LANDFORM AND SLOPE	TYPICAL SOIL PROFILE [†] – LAYERS, THICKNESS OF LAYERS, DEPTH TO ROCK, UNIFIED ENGINEERING CLASSIFICATION (PROFILES NOT TO SCALE)					RATING [‡] AND MAJOR LIMITING SOIL CHARACTERISTICS [§] FOR:						REMARKS		
			HIGH WATER TABLE DEPTH	PERMEABILITY	SHRINK-SWELL POTENTIAL	SEWAGE LAGOONS	SANITARY LANDFILL	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFICABILITY					
1	Lebanon	Broad, gently sloping ridgetops. Slopes range from 2 to 14 percent.	cm	CL-ML CL	Silt loam.	0.5-1m (1.5-3 ft) perched	Moderate above fragipan; slow in fragipan.	Moderate in clays above and below fragipan; otherwise low.	Severe q, s	Severe q	Moderate h, q	Moderate a, c, s	Severe q	Dry-Slight Wet-Moderate h, q	Perched water table during December through March.	
	15	CL	Silty clay loam and silty clay.													
	58	CL SC GC	Fragipan: cherty silt loam and silty clay loam.													
	90	CL CH SC GC	Cherty silty clay and clay.													
	152		Depth to bedrock generally > 3m (10 ft).													
	Viraton	Gently to moderately sloping convex ridgetops. Slopes generally range from 2 to 14 percent.	cm	CL-ML CL-ML	Silt loam.	0.5-1m (1.5-3 ft) perched	Moderate above fragipan; slow in fragipan.	Moderate in clay below fragipan; otherwise low.	Severe q, s	Severe q	Moderate h, q	Moderate a, c, s	Severe q	Dry-Slight Wet-Moderate h, q	Perched water table during December through March.	
			25	CL SC	Silty clay loam.											
			50	SC CL GC	Fragipan: extremely cherty silt loam.											
			94	SC CL GC	Clay.											
			152		Depth to bedrock generally > 2m (6 ft).											
Clarksville			Generally on side slopes. Slopes range from 2 to 60 percent.	cm	GC SC SM-SC GP-GC	Very cherty silt loam.	None	Moderate	Low	Severe p, s	Severe p, s	Moderate to Severe s	Moderate to Severe a, s	Moderate to Severe c, s	Moderate to Severe h, s	Severely eroded in places.
33	GC SC SP-SC GP-GC	Very cherty silty clay loam.														
119	GC SC GP-GC SP-SC	Very cherty silty clay.														
203		Depth to bedrock generally > 2m (6 ft).														
2	Lebanon														Refer to data on Lebanon series in Map Unit 1 above.	
	Gatewood	Strongly sloping to steep side slopes, ranging from 2 to 30 percent.	cm	CL GC SC	Cherty silt loam.	None	Slow below surface loam.	Low in surface loam; high in clay subsoil.	Severe b, s	Severe b, s	Severe s, z	Severe l, z	Moderate to Severe b, s	Moderate to Severe s, z		Severely eroded in places.
			13	CH	Clay.											
			74	CH SC	Clay and clayey sand.											
			91		Depth to bedrock generally about 1m (3 ft).											

D. ENGINEERING SOILS (Continued)

MAP UNIT	MAJOR SOIL SERIES*	LANDFORM AND SLOPE	TYPICAL SOIL PROFILE† – LAYERS, THICKNESS OF LAYERS, DEPTH TO ROCK, UNIFIED ENGINEERING CLASSIFICATION (PROFILES NOT TO SCALE)	HIGH WATER TABLE DEPTH	PERMEABILITY	SHRINK-SWELL POTENTIAL	RATING‡ AND MAJOR LIMITING SOIL CHARACTERISTICS§ FOR:						REMARKS
							SEWAGE LAGOONS	SANITARY LANDFILL	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFICABILITY	
3	Clarksville	_____		_____	_____	_____	_____	_____	_____	_____	_____	_____	Refer to data on Clarksville series in Map Unit 1 above.
	Claiborne	More gently sloping foot- slopes. Slopes range from 3 to 45 percent.	cm <div><div>ML CL CL-ML</div>Silt loam.</div> 43 <div><div>CL</div>Silty clay loam.</div> 117 <div><div>MH CH</div>Plastic silts and silty clays.</div> 216 <div>Depth to bedrock generally > 2m (6 ft).</div>	None	Moderate	Moderate below 43 cm (17 in); low in surface layer.	Moderate to Severe s	Moderate to Severe s	Moderate to Severe s, x	Severe l	Moderate to Severe c, s	Moderate to Severe s, x	
	Doniphan	Generally on narrow ridgetops. Slopes vary between 2 and 60 per- cent.	cm <div><div>CL-ML GM GM-GC SM-SC</div>Cherty silt loam.</div> 30 <div><div>CL</div>Silty clay.</div> 40 <div><div>CH MH</div>Mixed subsoil and surface materials.</div> 69 <div><div>CH MH</div>Clay.</div> 196 <div>Depth to bedrock generally > 2m (6 ft).</div>	None	Moderate	Moderate below 30 cm (12 in); low in surface layer.	Moderate to Severe p, r, s	Severe p, s	Moderate to Severe s, x	Severe l, s	Moderate to Severe c, s	Moderate s, x	Moderately to severely eroded in places.
4.	Huntington	Nearly level to gently sloping flood plains and terraces next to active stream channels. Slopes are between 0 and 15 percent.	cm <div><div>ML CL</div>Silt loam.</div> 28 <div><div>ML CL</div>Silt loam.</div> 163 <div><div>SM SC ML CL</div>Sandy clay loam.</div> 188 <div>Depth to bedrock generally > 2m (6 ft).</div>	1.2-1.8m (4-6 ft)	Moderate	Low	Severe f	Severe f	Severe f	Severe a, f	Moderate f	Moderate f	Water table highest during December through April.

*Soils that have profiles almost alike make up a soil series. Each series is given a common name after a town or geographic feature near its initial observation. Many other minor soils may be included in the map unit.

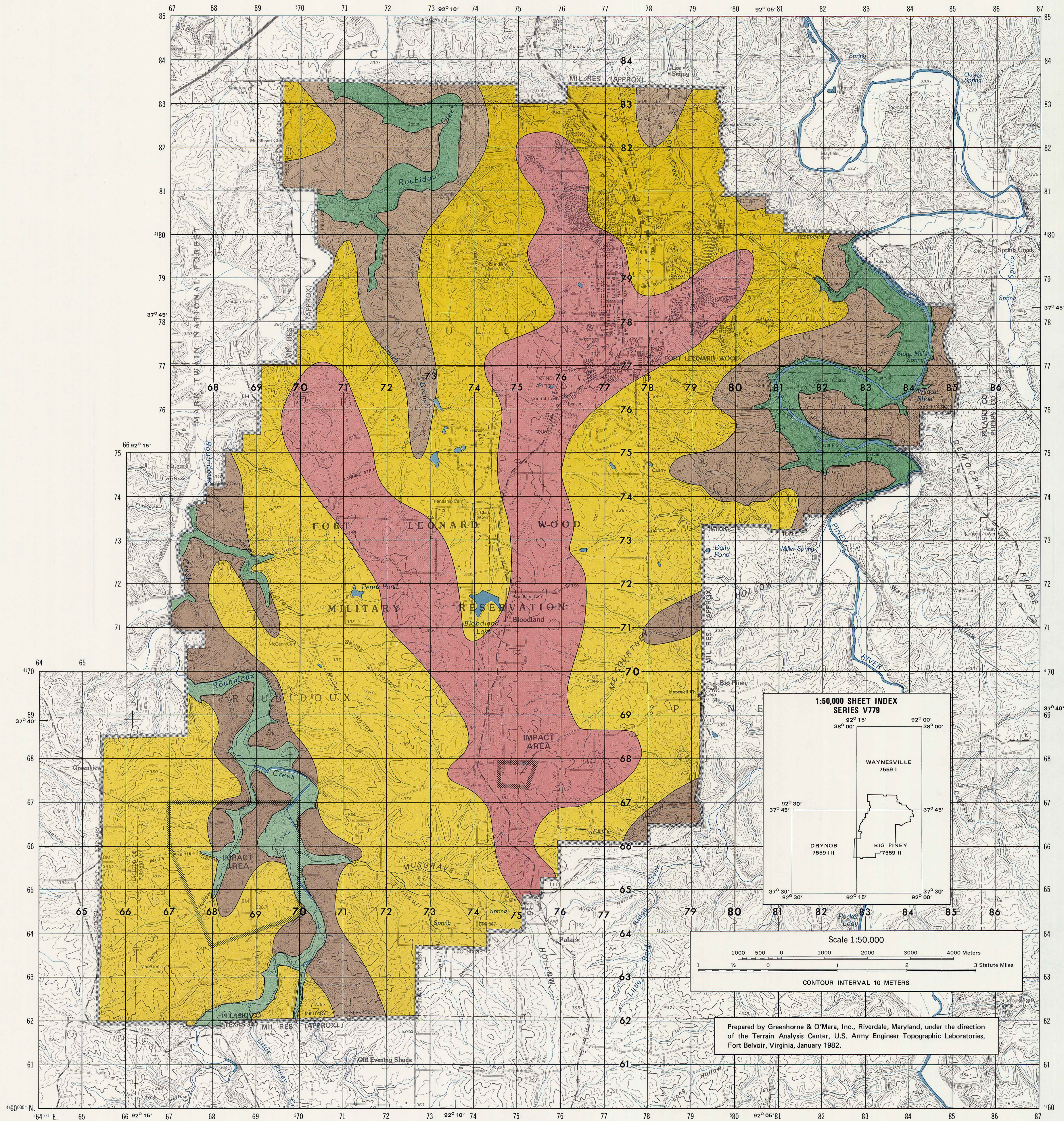
†These are typical average layers based on the major soil series; thicknesses and composition may vary considerably from those shown.

‡Definitions of rating terms:
Slight = relatively free of limitations or limitations are easily overcome.
Moderate = limitations can be overcome with good planning and/or careful design.
Severe = limitations are serious and are difficult to overcome.

§Soil characteristics affecting ratings:

- a = frost action
- b = shallow bedrock
- c = clayey subsoil-poor workability
- f = flooding
- h = sinkhole terrain
- l = low bearing strength
- p = rapid percolation
- q = high water table
- r = large stones
- s = steep slope
- x = moderate shrink-swell potential
- z = high shrink-swell potential

NOTE: Steep slope "s" constitutes severe limitations when slope exceeds:
7% for Sewage Lagoons,
15% for Sanitary Landfill (area-type),
Foundations for Small Buildings,
Road Locations, and
Shallow Excavations,
25% for Sanitary Landfill (trench-type) and Trafficability.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

ENGINEERING SOILS

SOILS OF THE UPLANDS

1. Well drained to excessively drained soils in loess and cherty residuum. Fragipan in gently sloping areas. (Lebanon-Viraton-Clarksville)
2. Moderately well drained soils. Fragipan on ridges and plateaus. (Lebanon-Gatewood variant)
3. Well drained to excessively drained soils in cherty residuum and colluvium. (Clarksville-Claiborne-Doniphan)

SOILS OF ALLUVIAL PLAINS AND TERRACES

4. Well drained to poorly drained flood plain and terrace soils. (Huntington)

NOTE: Number refers to entry in table.

E. ENGINEERING GEOLOGY

The table below and the accompanying Engineering Geology map indicate the extent and distribution, geologic characteristics, and geotechnical properties of five engineering geology units on Fort Leonard Wood. These units are evaluated as to their topographic and geotechnical suitability for construction sites and route alignments, foundation stability for supporting light and heavy structures, cut-slope stability for road and bridge construction, and their potential as sources of construction materials. Key geographic and geotechnical characteristics, such as the occurrence of sinkholes, subsurface solution channels and joints, relative resistance to erosion, suitability for excavation and compaction, frost susceptibility, and swelling potential are also evaluated to determine additional impacts or constraints to engineering development. The units are divided into two major suitability categories, those having some and those having few engineering uses.

The geologic units on Fort Leonard Wood consist primarily of three formations of flat-lying dolomitic limestones deposited in shallow seas during the early part of the Paleozoic era, and uplifted near the beginning of the Pleistocene Ice Age. One of these units, the Roubidoux Formation, contains fine-grained quartz sandstone members of varying thickness which may have originated as beach deposits during periods of receding, then encroaching seas. Structurally, the Fort Leonard Wood area is within the Salem Plateau of the Ozark Plateaus Province, about 30 kilometers (18 miles) west of the Saint Francis Mountains. Locally, the plateau gently slopes toward the northwest at about 6 to 9 meters (20 to 30 feet) per mile. The dolomitic formations in the area are particularly susceptible to solution activity. Persistent strata tend to dip into valleys in the Ozarks, partly due to solution activity in the more soluble underlying members. Furthermore, more than a thousand roofless solution cavities filled with rock debris and overburden have been reported on the northern and western slopes of the Ozark Plateau. A portion of the Fort Leonard Wood reservation is identified as a karst area, and may contain solution cavities of unknown dimensions not yet in evidence at the surface of the ground.

The youngest sediments on Fort Leonard Wood are unconsolidated alluvial deposits consisting of gravel, sand, and silt. These sediments, depicted as Unit 4 on the Engineering Geology map, occur in the flood plains of the Big Piney River on the east side of the reservation, and the Roubidoux Creek which roughly parallels the western boundary. Closely associated with the flood plain sediments are the stony sandy clay colluvial deposits, Unit 5, which are found in the channels of the major intermittent tributaries of the Roubidoux Creek and Big Piney

River, and on the edges of the flood plains. These deposits, both the alluvial and colluvial, exhibit generally poor foundation stability, particularly for heavy structures, and are subjected to occasional flooding.

In the southern part of the reservation, the predominant formation occupying the higher elevations of the plateau surface is an argillaceous fine-grained dolomite with minor amounts of interbedded sandstone and shale. This is the Jefferson City Formation of Ordovician age, Unit 1. It contains a persistent member, locally called the Quarry Ledge, which could provide excellent support for heavy structures. In many places, however, the Jefferson City Formation weathers to a plastic clay of low permeability, and could result in severe drainage problems.

Unit 2, which underlies Unit 1, contains the interbedded cherty dolomites and sandstones of the Roubidoux Formation. This unit averages more than 40 meters (130 feet) in thickness, and occurs as the uppermost formation over about two-thirds of the Fort Leonard Wood reservation, including virtually all of the cantonment area. The sandstone members, although not abundantly represented in the formation, are frequently conspicuous as protruding ledges. The Roubidoux Formation is overlain by a deep mantle of residual soil, moderately permeable at the surface, but water percolation is frequently restricted by a fragipan horizon less than one meter (three feet) below the surface. Because of the high susceptibility to solution weathering and sinkhole-type collapse, construction site selection must be preceded by a closely spaced borehole investigation.

Unit 3 represents the upper portion of the oldest rock unit exposed on the reservation, the Gasconade Formation of Lower Ordovician age. This fine to coarsely crystalline dolomite is found at the lowest elevations, flanking major stream flood plains and below the Roubidoux Formation in the dissected part of the plateau. Because it is only on steeply sloping terrain, this unit is not suitable for construction site location. It does, however, contain the only active rock quarry on the reservation, and is the source of aggregate for local construction in conjunction with troop training projects.

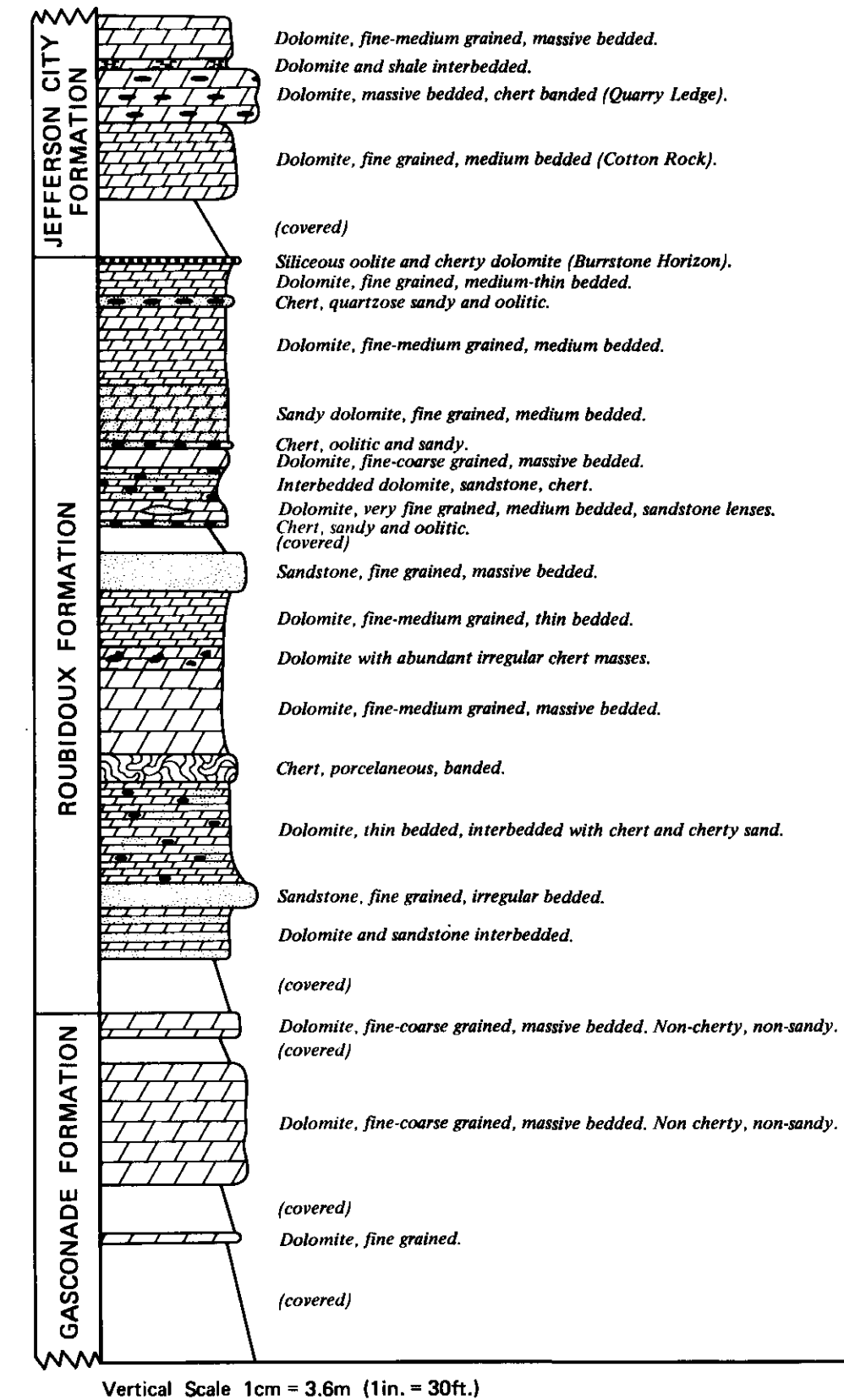
Although carbonate rocks predominate in this area, their use as concrete aggregate is frequently limited by chert impurities. Likewise, the sandstones are generally low in abrasion resistance and cannot be considered as a major source of aggregate.

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
1. Very fine-grained, thin-to massive-bedded clayey to silty dolomite with numerous sandstone lenses.	The major portion of this unit is in the south central part of the reservation, on either side of the main road (Route 1) from about two kilometers (1.25 miles) north of Bloodland to the southern boundary of the reservation. Other exposures occur in the southwest portion of the installation along the southern and western boundaries. Limited exposures are also west of the cantonment area at higher elevations on either side of Roubidoux Creek. Overall, the unit covers almost 20 percent of the reservation area.	Consists of Ordovician Jefferson City Formation. Two lithologic types of dolomite are common in this unit. The lower 7 to 8 meters (23 to 26 feet) consists essentially of light gray to buff colored, thin- to massive-bedded, clayey to silty, medium to finely crystalline dolomite locally referred to as "cotton rock". Above the "cotton rock" is a buff to gray, thin- to massive-bedded somewhat siliceous crystalline persistent bed of dolomite, up to 3 meters (10 feet) thick, locally called the Quarry Ledge. This member of the unit normally contains abundant small cavities filled with fine white crystalline quartz. It weathers to a uniformly pitted, medium gray surface. Above the Quarry Ledge, the predominant lithologic type is again "cotton rock".	Permeability- poor except along solution passages Swelling potential- noncritical Frost susceptibility- slight in bedrock, moderate in clay overburden.	Level area, primarily in southern part of reservation, offers limited space for multi-structure emplacements. Quarry Ledge, where at or near the surface, provides stable base for heavy construction. Plastic clays in other areas are poor for foundations. Test borings are necessary to negate possibility of solution cavities in bedrock. Small cavities may be filled with crushed rock prior to commencement of construction. Alignments generally do not require cuts and fills. Existing roads follow most desirable terrain features. New road construction could necessitate adding granular base course because of plastic soil. Where thick-bedded, dolomites provide good dimension stone. Crushed rock yields aggregate of moderate strength and durability. The use of crushed dolomite in bituminous pavement is not recommended because of poor skid resistance. It does, however, provide adequate loose surfacing material for lightly trafficked secondary roads. Chert, where present, reduces usability of unit as aggregate. Thin-bedded sandstone and shale are not useable as aggregate. Residual clays may be suitable for fill if properly dried, blended with granular material, and compacted.	Excavation of windblown silt (loess) overburden is generally easy with hand tools. Removal of plastic clay overburden, however, can be difficult with hand tools. Where a fragipan horizon is present, excavation with hand tools is also difficult. Excavation of bedrock is difficult, and blasting is required. Excavating equipment generally has easy access to major portions of the unit through existing roads. Access to other areas will be hindered by dense vegetation.	There are no quarries in operation in this unit. One abandoned quarry is at grid reference 747649. Exposures of Quarry Ledge in southern part of reservation can be quarried for dimension stone and aggregate.
	This unit occupies the higher elevations of the dissected plateau, including relatively flat upland surfaces and the low rolling hills generally found at elevations below the Quarry Ledge, a resistant layer found at about 7 to 8 meters (23 to 26 feet) above the base level of the unit. Several small and fairly shallow sinkhole depressions are at various locations. Residual soil cover generally ranges from zero to over 6 meters (20 feet). Where not capped with loess, the soils frequently are plastic, somewhat stony, and have low permeability.	The lower part of the Jefferson City Formation frequently contains local lenses of sandstone or shale less than 30 centimeters (1 foot) thick. Minor amounts of chert, commonly occurring as light colored porcelaneous to porous rounded nodules, may also be present.		Unit is moderately suitable for area type solid waste disposal. Plastic clay base and cover properly applied will inhibit leachate from entering groundwater. Unit is generally poor for sewage disposal where plastic clays and/or fractures and solution passages in the dolomite are limiting factors.	The overburden generally ranges from zero to slightly over 6 meters (20 feet) in depth.	
	Local relief averages about 30 meters (100 feet) in the northern exposures, increasing to about 40 meters (130 feet) towards the southwest. The highest elevation of this unit is 395 meters (1296 feet) at grid reference 741687. As a result of the unit gently dipping about 1.9 meters per kilometer (10 feet per mile) towards the north, the lowest elevation is at the base of the formation in the vicinity of grid square 7182 where the elevation at the base of the formation is approximately 310 meters (1017 feet) above sea level. The drainage pattern on this unit is not well developed. Only a few relatively shallow gullies are found in the lateral areas. Where soil permeability permits, a portion of the drainage may be subsurface through solution passages in the dolomite.	The maximum thickness of this unit is about 76 meters (250 feet), but only the lower 40 meters (130 feet) of the formation are present on the Fort Leonard Wood Reservation.				
2. Interbedded cherty and sandy dolomite and sandstone.	This unit covers nearly two-thirds of the installation, including almost all of the cantonment area. In the northern part of the reservation, where the cantonment area is located, it forms the broad, fairly level to gently sloping upper plateau surface. Elsewhere, it forms the gentler upper slopes of the valleys bordering the local portion of the plateau. In places, the persistent thick sandstone members form ridges in the valley walls. Several small sinkholes are found at various places, but a group of five or six is located in the vicinity of grid square 7275. Residual soils are extremely variable in character, and range from moderate to very deep. Soil depths of as much as 26 meters (85 feet) have been noted.	Consists of Ordovician Roubidoux Formation. The Roubidoux Formation varies considerably in lithology, both vertically and laterally. It consists predominantly of various interbedded combinations of dolomite, quartz sandstone, and chert. In overall area, dolomite is the primary rock type, although locally sandstone may be the most visible by prominent ledge exposures on hillsides and in gullies.	Permeability- good in sandstone, poor in dolomite except along solution passages and fractures. Swelling potential- noncritical Frost susceptibility- slight in bedrock, moderate in clay overburden	Level to gently sloping surfaces in the cantonment area, and open areas to the south and southwest of the cantonment area offer adequate space for multi-structure emplacements. Other areas, particularly in the southwest and southeast quadrants provide limited emplacement space. These are fairly broad ridgetops between roughly parallel hollows.	Excavation of the thick overburden is easy with hand tools at and near the surface, but becomes difficult at and below the fragipan horizon.	There are no quarries in operation in this unit. One abandoned quarry is at grid reference 780747. No new quarries are recommended.
	In places, the persistent thick sandstone members form ridges in the valley walls. Several small sinkholes are found at various places, but a group of five or six is located in the vicinity of grid square 7275. Residual soils are extremely variable in character, and range from moderate to very deep. Soil depths of as much as 26 meters (85 feet) have been noted.	The dolomites for the most part are fine-grained, light gray to light brownish gray, and thinly to massively bedded. Sand grains are commonly scattered throughout the dolomite. Chert is frequently abundant in the form of angular fragments, thin lenses, and small irregular masses.		Alignments in the level uplands generally do not require cuts and fills. Alignments transverse to the dissected margins, however, would require a moderate amount of cut and fill, and bridging would be necessary over some steep and deep gullies.	Due to differential weathering, the top of the bedrock surface is highly irregular, from one meter (3 feet) to as much as 26 meters (85 feet) below the surface. Extrapolation of subsurface conditions between trenches or borings is questionable. The limits and extent of the chert, sandstone, and dolomite rock layers are not always definable by use of test pits and borings. Some rock excavation should be expected for foundation grades for large structures. Cherty soil may be difficult to work.	
	Local relief averages about 40 meters (130 feet) in the areas of Roubidoux Formation exposures near the major streams. In the northern part of the reservation in the vicinity of the cantonment area, local relief is reduced to about 30 meters (100 feet). The highest elevation of this unit is 350 meters (1148 feet) generally in the southwestern part of the reservation. The lowest elevation is at about 270 meters (885 feet) in the area of grid square 7182. The drainage pattern in this unit is a moderately developed dendritic pattern characteristic of essentially flat-lying strata of uniform density. In the southern half of the reservation, where overlain by the Jefferson City Formation, the Roubidoux Formation tends to have steeper valley gradients than when it is the uppermost unit.	The sandstone members of the Roubidoux Formation are fine-grained, gray through brown and red, medium to massively bedded. Individual members range in thickness from less than 3 centimeters (1 inch) to almost 9 meters (30 feet), and are more common in the upper part of the formation. The cementing material is more commonly dolomite, but iron oxide and secondary quartz overgrowth may also be present. In many parts of the formation, the sandstone is well bedded and splits easily into flagstone. Ripple marks, cross-bedding, and preserved mud cracks are common.		Secondary roads or trails are available in the vicinity of most potential construction sites in the northern half of the reservation, but fewer roads exist in the southern half.	The majority of the rocks composing this unit cannot be easily excavated by hand tools. Massive bedded dolomite and sandstone, where not weathered, will require blasting and heavy duty equipment. Access of excavating equipment to many areas will be hindered by dense vegetation.	
		The chert is highly variable in form, ranging from the more common sandy and oolitic varieties to dense porcelaneous and banded varieties. It occurs in several forms, including thin, irregular shaped nodules in the dolomite, and in irregular layers up to 3 meters (10 feet) thick.		Soil is generally well drained above the fragipan horizon, but varies greatly in composition and overall thickness. Suitability for foundations varies from good to poor depending on grain size, mixture, and density. In addition, the bedrock is very susceptible to solution weathering, and subsurface erosion and slump may produce cavernous openings in the residual soil overburden with no surface expression of their existence. Building construction in these areas should be preceded by close-spaced borings to sufficient depth to insure a firmly supported foundation.	Cut slopes in massive bedded dolomite and sandstone stand vertical. Thin-bedded and interbedded dolomites and sandstones tend to erode more readily.	
		This unit averages 40 meters (130 feet) in thickness.		Dolomite members of this unit generally do not provide good aggregate because of the high chert content. The sandstone members are generally low in abrasion resistance, and cannot be considered a major aggregate source. Throughout most of the area, the sandstone easily splits into flagstone and is widely used as building facing. Sand from the formation is normally too fine grained for use in concrete. Because of the great lateral and vertical variations in soil conditions as well as the karst topography, the area is generally poorly suited for solid waste disposal. If necessary, sites can be selected, but must be based on detailed soils investigation to locate areas least likely to contaminate groundwater by leachate infiltration. The unit is generally unsuited for disposal of liquid waste because of the impermeable fragipan horizon and the uncertain depth to bedrock.		

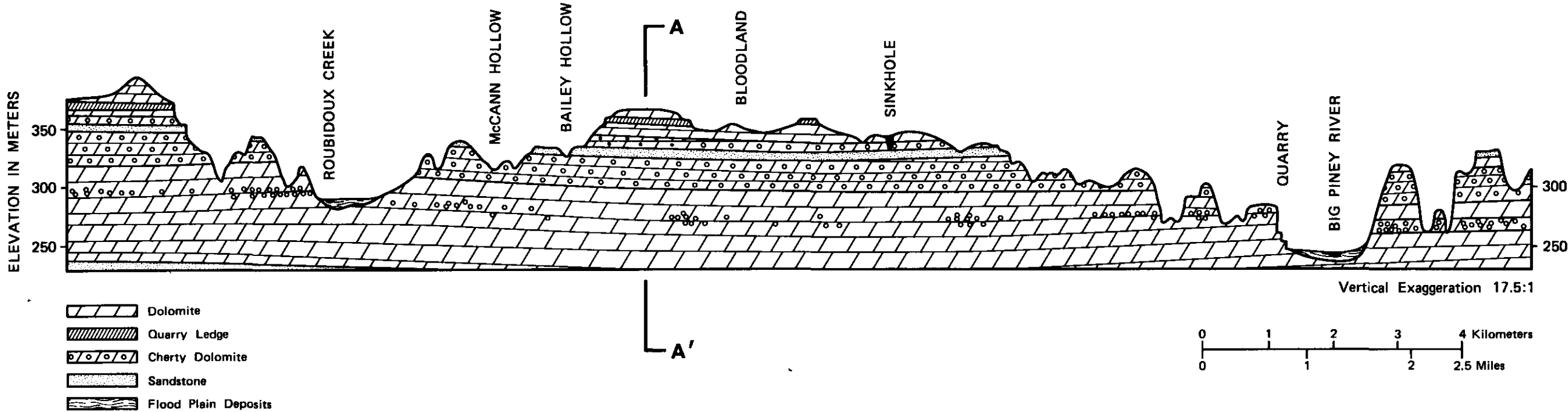
E. ENGINEERING GEOLOGY (Continued)

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
3. Fine- to coarse-grained, medium- to massive-bedded, non-sandy dolomite.	<p>This unit is found only along the valley walls of the Big Piney River and the Roubidoux Creek, and along the fairly steep-gradient intermittent tributaries of those two streams. Slopes along the valley walls and V-shaped gullies are moderate to steep. Residual soil cover varies from zero to normally less than 3 meters (10 feet).</p> <p>Local relief averages about 50 meters (164 feet) in the northeast near the Big Piney River, but is normally less in other areas. In the southwest portion of the reservation, local relief in the Gasconade Formation is about 20 meters (65 feet). The highest elevation is about 310 meters (1017 feet) in the southwest at grid square 6862, while the lowest elevation, 250 meters (820 feet), is along the Roubidoux Creek at grid square 7183. Drainage in this unit consists of the lower reaches of the dendritic patterns which begin in the Jefferson City and Roubidoux Formations, and form intermittent tributaries of the Big Piney River and Roubidoux Creek.</p>	<p>Consists of Lower Ordovician Gasconade Formation.</p> <p>This unit consists primarily of light gray to brownish gray, fine- to coarse-grained, medium to massively bedded dolomite. In contrast to the Roubidoux Formation above, the Gasconade is relatively free of sand and rarely contains chert in any significant quantities in those sections outcropping on the Fort Leonard Wood reservation. Where chert does appear, it constitutes less than 10 percent of the upper portion of the formation, and occurs as brownish-gray to gray irregular shaped masses. Farther down in the Gasconade section, about 15 to 21 meters (50 to 70 feet) below the top of the formation, a very cherty persistent horizon appears to be fairly widely distributed. In further comparison, the grain size of the dolomite is generally larger and the bedding is better developed than that of the Roubidoux Formation.</p> <p>The Gasconade Formation averages about 94 meters (315 feet) in thickness, but only the upper 50 meters (164 feet) is exposed on Fort Leonard Wood. In many areas, the upper portion is highly soluble and contains numerous caves and springs, and weathers to a coarse pitted medium gray surface. The lower part of the formation, mostly subsurface on the reservation, contains large amounts of chert which often exceed 50 percent of the rock volume. The basal unit of the Gasconade, the Gunter Member, is a fine-grained quartzose sandstone about 7 to 9 meters (25 to 30 feet) thick. It is a good aquifer in central Missouri.</p>	<p>Permeability- poor</p> <p>Swelling potential- noncritical</p> <p>Frost susceptibility- slight</p>	<p>Unit is generally unsuited for all types of construction. Alignments normally require a considerable amount of cut and fill when paralleling flood plain. Alignments following tributary valleys also require cuts along most of their length. Some existing secondary roads between cantonment area and major stream valleys are aligned with tributary valleys.</p> <p>Because of excessive slope, unit is unsuited for building construction.</p> <p>Upper portion of formation, where massive-bedded, chert-free, non-sandy dolomite is exposed, provides aggregate of moderate strength and durability. The only active quarry on Fort Leonard Wood and at least five abandoned quarries are in this formation. Aggregate from the rock crusher operated at the quarry is used for many troop projects on the reservation, including concrete, bituminous pavement, and fill.</p> <p>The unit is unsuited for the disposal of all waste because of excessive slope and seepage into the highly soluble bedrock.</p>	<p>Excavation of overburden is moderately easy to difficult with hand tools, depending on the extent and size of rock material in the residuum. Excavation of bedrock is difficult; blasting and heavy duty equipment are required. Excavating equipment has easy access to operational and abandoned quarries. New quarry sites probably require road construction involving removal of vegetation and possibly cut and fill.</p> <p>The overburden is generally less than 3 meters (10 feet) thick, but may be locally thicker.</p> <p>Cut slopes in the massive bedded dolomite stand vertical.</p>	<p>One dolomite quarry (grid reference 819748) is in operation in this unit and providing materials for troop construction projects. Five abandoned dolomite quarries are at grid references 714802, 749799, 822788, 832770, and 818788. Other exposures along the Big Piney River can be quarried for aggregate.</p>
4. Unconsolidated alluvial gravel, sand, and silt.	<p>Occupies the level flood plains of the Big Piney River and Roubidoux Creek. The flood plains are bounded by the fairly steep bluffs formed by the Gasconade and Roubidoux Formations, and in places by colluvial terraces contiguous to the bluffs.</p> <p>Local relief is generally less than 5 meters (16 feet). The highest elevation along the Roubidoux Creek is 300 meters (984 feet) at the southern boundary of the reservation. The highest elevation along the Big Piney River is 250 meters (820 feet) where it becomes coincident with the reservation boundary at grid reference 822736. The lowest elevation of both streams is 240 meters (787 feet) at the points where they leave the northern part of the reservation. The entire unit is subject to periodic flooding. A considerable stretch of the Roubidoux Creek, however, is normally dry because of upstream capture where it goes underground into a karst solution channel (underground river) approximately 1 kilometer (0.62 mile) west of the reservation boundary (grid reference 663700).</p>	<p>Holocene Big Piney River and Roubidoux Creek alluvium, mostly river deposited fine-grained quartz sand derived from the sandstone outcrops on either side of the flood plain. The sands are generally capped with silt of high organic content. Stream channels, both active and former channels, contain gravel and sand-gravel mixtures consisting of chert and weathered dolomite. Along the captured reach of the Roubidoux Creek, the deposits flanking the channel beds tend to be of a finer texture and frequently consist of a silt veneer over weathered clay.</p>	<p>Permeability- moderate to high</p> <p>Swelling potential- Noncritical</p> <p>Frost susceptibility- Moderate</p> <p>Plastic index less than 10</p> <p>Liquid limit- minimum 25 (average 32)</p>	<p>Predominantly flat flood plains in the valleys of the Big Piney River and Roubidoux Creek provide curving alignments for roads and railroads. Stream meanders extend to steep valley walls, so new road construction would require moderate cuts and fills; extensive cuts and fills and/or bridging would be required for railroad construction.</p> <p>Foundation stability of the surface material down to about 3 meters (10 feet) is fair to poor. Stability improves with depth into the compacted silt and sand layers. The entire area is subject to flooding and frost action, not as severe, though, in the captured reach of the Roubidoux Creek. Foundations for structures would require spread footings to prevent settling, and heavy structures would require pilings.</p> <p>Alluvial deposits are moderately suitable for subgrade and fill materials if properly compacted. The sand deposits are derived from the sandstone in the formations above the stream valleys and are generally too fine grained for concrete. The river gravels consisting of chert and weathered dolomite are suspect for concrete pavement because of insufficient durability.</p> <p>The unit is not suitable for waste disposal, solid or liquid, because of the high water table and susceptibility to flooding.</p>	<p>Alluvial deposits are easily excavated with hand tools and power equipment in most areas. Clay deposits along Roubidoux Creek, especially in captured reach, can be difficult to excavate with hand tools. Access to areas along the Big Piney River and the northwest reach of the Roubidoux Creek are easy through existing roads. Much of the southwest reach of the Roubidoux Creek is currently inaccessible because of inadequate roads and the location of the main artillery and bombing impact area.</p> <p>Excavations are subject to periodic flooding by the two major streams. The high water table of 1.2 to 1.8 meters (4 to 6 feet) precludes deep excavation.</p>	<p>There are no pits or quarries in operation in this unit. Three abandoned gravel pits are at grid references 819750, 824751 and 831751. No new sites are recommended.</p>
5. Unconsolidated colluvial deposits.	<p>This unit occupies numerous terrace areas between the major stream flood plains and the steep bluffs of the valley walls, normally abutting the lower exposures of the Gasconade Formation. It also constitutes the sedimentary deposit in the valleys of the larger intermittent tributaries of the Big Piney River and the Roubidoux Creek.</p> <p>Local relief is generally 3 to 9 meters (10 to 30 feet) above the flood plain, and gradually diminished toward the stream channel.</p>	<p>Holocene colluvial deposits of silty, sandy, stony clay weathered and eroded from the sandy and cherty dolomites which form the adjacent slopes. These deposits have very high percentage of plastic clay and are relatively impermeable. The stony component consists of chert and dolomite fragments of varying sizes and shapes.</p>	<p>Permeability- Low</p> <p>Swelling potential- High</p> <p>Frost susceptibility- Moderate to high</p>	<p>Predominantly gently sloping isolated terraces or narrow intermittent stream valleys provide adequate alignments for roads only in combination with other units. Moderate cuts and fills required to maintain road leveling through unit and in transition to other units. Thick base course materials would need to be added over cut road surfaces to maintain stability.</p> <p>No extensive terrain is available for multi-structure emplacements. Access is easy through existing roads in the Big Piney River Valley, but difficult in other locations due to lack of roads.</p> <p>Foundation stability or the use as fill material is generally very poor because of the high plastic clay content. The unit is not recommended for most construction projects, nor for the disposal of waste materials.</p> <p>These deposits may be suitable for fill if properly dried, blended with granular material, and sufficiently compacted.</p>	<p>Excavation of colluvial deposits is moderately easy to difficult with hand tools, depending on the extent and size of rock detritus in the deposit. Excavation with power equipment is easy. Access to areas along the Big Piney River are easy through existing roads. Other areas, specifically the deposits in the valleys of the larger intermittent tributaries of the Roubidoux Creek, are mostly inaccessible without road construction.</p>	<p>There are no active or abandoned pits or quarries in this unit. No sites are recommended.</p>

REPRESENTATIVE SECTION OF BEDROCK THROUGH A-A' ON ADJACENT CROSS SECTION



REPRESENTATIVE CROSS SECTION OF FORT LEONARD WOOD, SOUTHWEST TO NORTH-NORTHWEST



F. SPECIAL PHYSICAL PHENOMENA

1. EARTHQUAKES

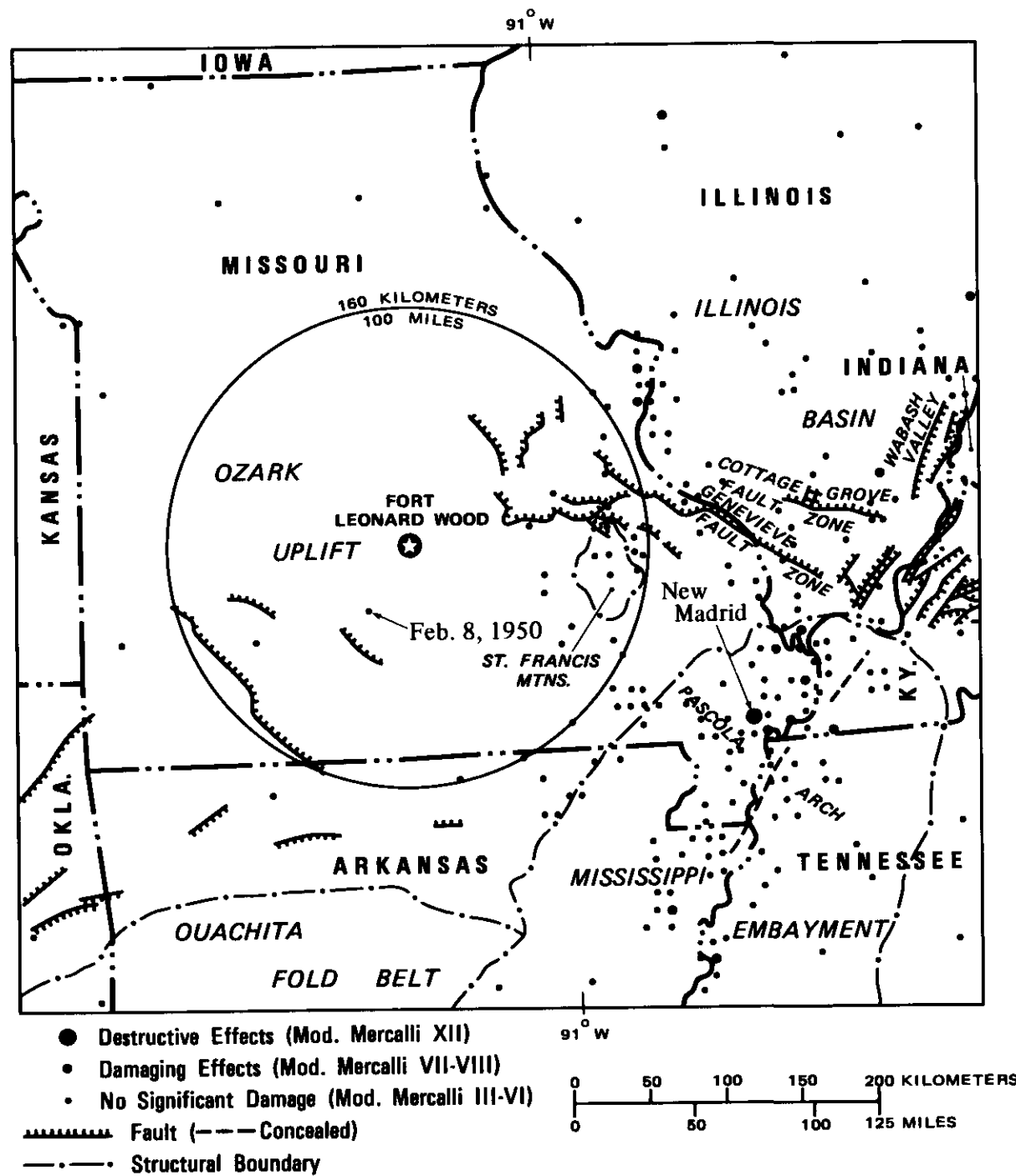
The maximum earthquake intensity that could be expected at Fort Leonard Wood would probably not exceed Intensity VI (Modified Mercalli Scale; see below). The Fort Leonard Wood reservation has experienced ground motions of less than Intensity IV from time to time in response to distant Intensity V to VII earthquakes.

Historic earthquake activity has been light in the immediate Fort Leonard Wood environs. The Seismotectonic Map of the Eastern United States indicates that the seismic frequency of earthquake epicenters is less than 8 per 10,000 square kilometers (3861 square miles) for the area of Missouri generally west of 91° West longitude. As shown on the accompanying "Regional Faults and Earthquake Epicenters" only 24 shocks of Modified Mercalli Intensity III to VI have been recorded within a 160-kilometer (100-mile) radius of Fort Leonard Wood from 1800 through 1972, an average of 4 shocks per 30-year period. Most of these were east of 91° West longitude where the frequency of epicenters is between 8 and 32 per 10,000 square kilometers (3861 square miles) and the distances are between 97 and 160 kilometers (60 and 100 miles) from Fort Leonard Wood. The closest recorded epicenter to Fort Leonard Wood was approximately 48 kilometers (30 miles) to the southwest on February 8, 1950. This earthquake, which corresponded to Intensity V on the Modified Mercalli Scale, was estimated to be less than Intensity IV in the Fort Leonard Wood area. No specific structural control has been indicated for this earthquake.

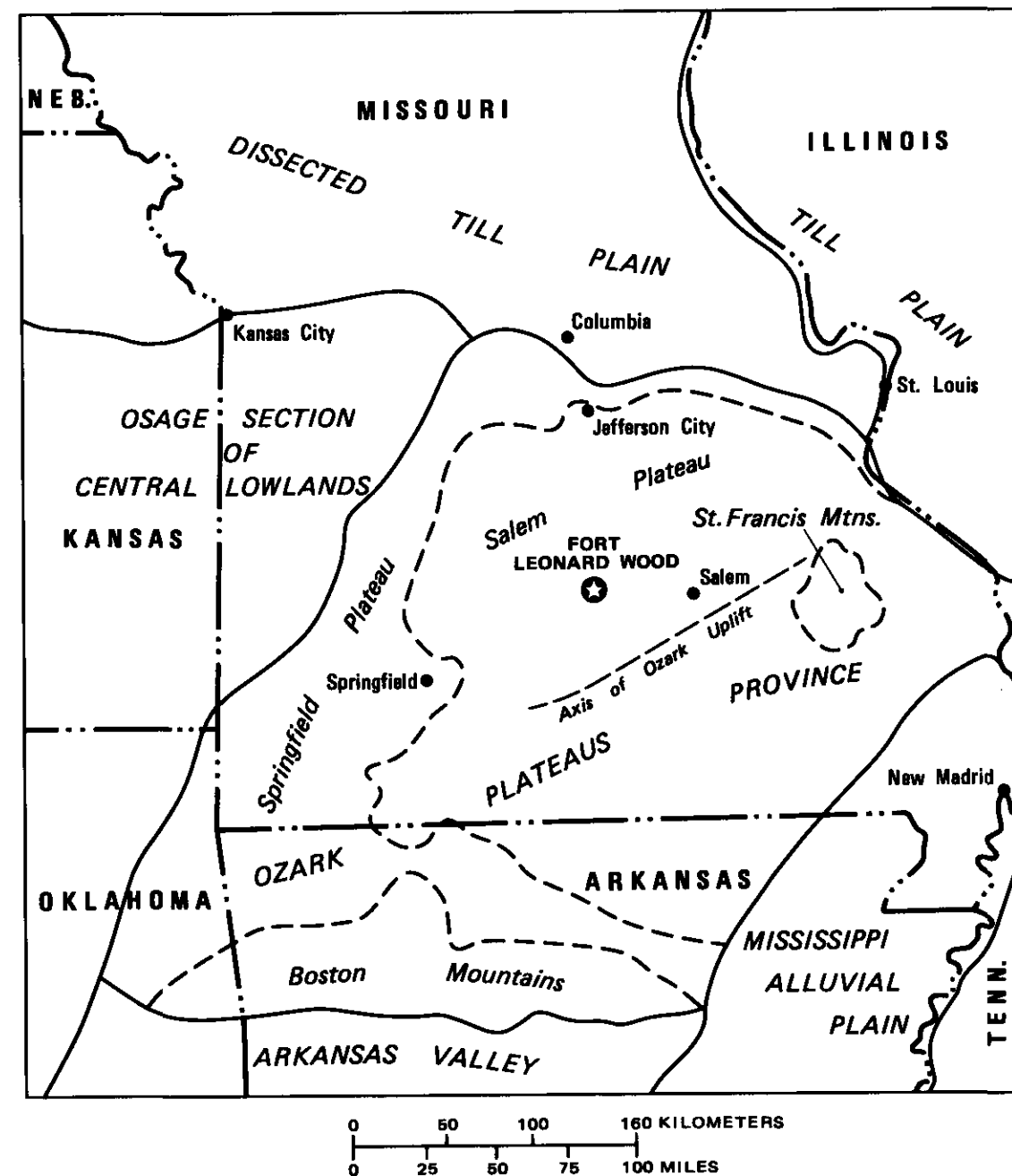
The closest major seismic activity to Fort Leonard Wood was a series of three earthquakes near New Madrid, Missouri, 265 kilometers (165 miles) to the southeast, in late 1811 and early 1812. The extent, severity, and topographic effects from these shocks have never been equaled by any other recorded earthquake in the 48 contiguous states. These shocks, corresponding to a devastating Intensity XII, were reportedly felt over a 5-million square kilometer (2-million square mile) area and as far as 1770 kilometers (1100 miles) away. Their strengths were reported to be less than Intensity VII in the vicinity of Fort Leonard Wood.

Fort Leonard Wood is situated on the gently sloping Salem Plateau. This area is part of the Ozark Plateaus Province, a broad, asymmetrical dome commonly referred to as the Ozark Uplift. The nearest major tectonic features are the St. Francis Mountains, the focal point for the Ozark Uplift, centered about 150 kilometers (93 miles) to the east, and the nearby fault zones to the northwest and northeast of the St. Francis Mountains. The rocks within the Salem Plateau are limestones, dolomites, and sandstones which dip gently away from the Ozark Uplift. Locally, in the Fort Leonard Wood area, they dip toward the north-northwest, away from the axis of the uplift which extends west-southwest from the St. Francis Mountains past Salem toward Springfield. There is no surface evidence of recent movement on the fault zones near Fort Leonard Wood.

REGIONAL FAULTS AND EARTHQUAKE EPICENTERS



REGIONAL PHYSIOGRAPHY



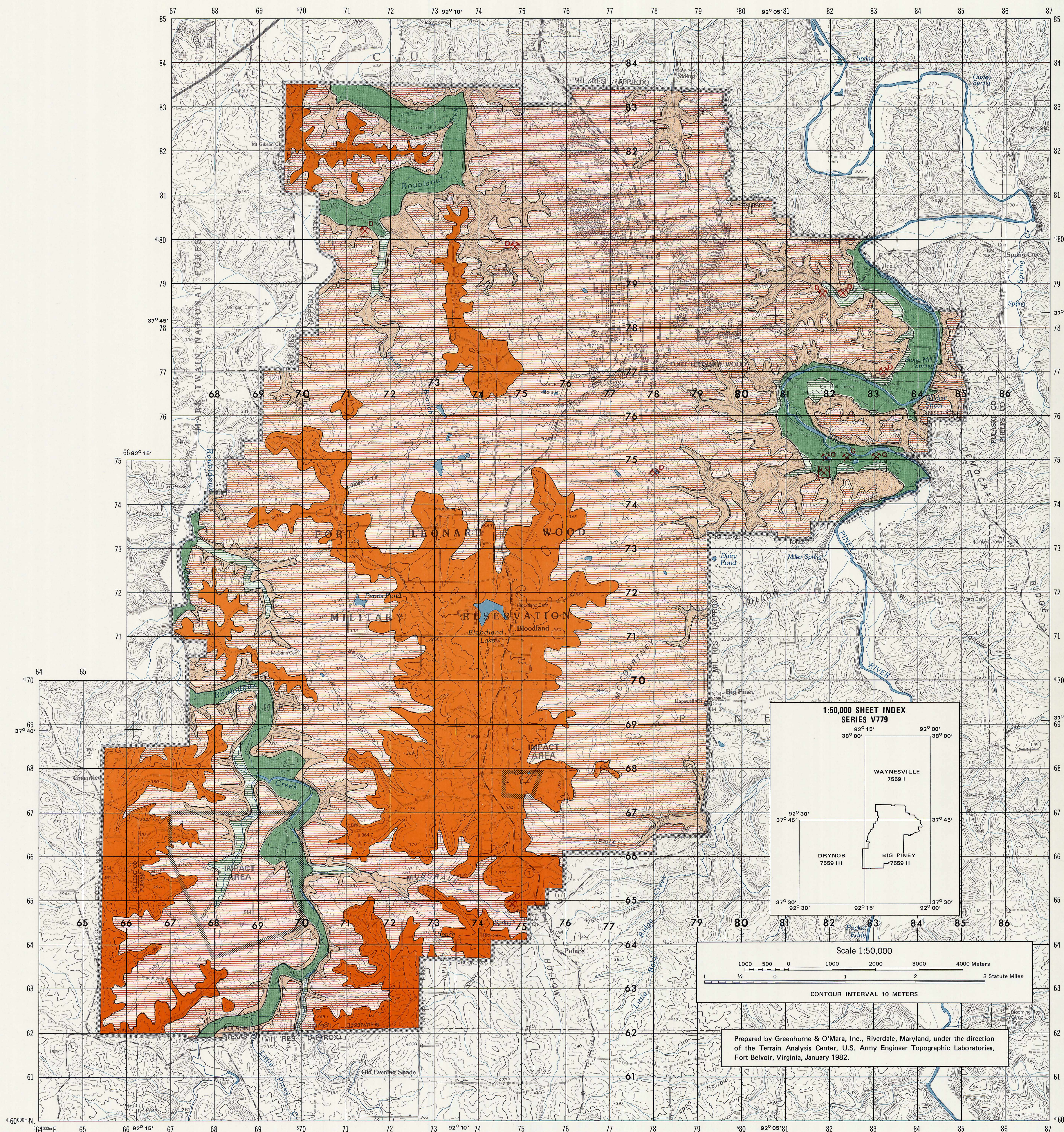
MODIFIED MERCALLI INTENSITY SCALE OF 1931 (Abridged)

- | | | | |
|------|---|-------|--|
| I. | Not felt except by a very few under especially favorable circumstances. | VIII. | Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed. |
| II. | Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. | IX. | Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. |
| III. | Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing truck. | X. | Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. |
| IV. | During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, and doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rock noticeably. | XI. | Few, if any (masonry), structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly. |
| V. | Felt by nearly everyone; many awakened. Some dishes, window, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. | XII. | Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into the air. |
| VI. | Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. | | |
| VII. | Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well built ordinary structures; considerable in poorly built or badly designed structures. Some chimneys broken. Noticed by persons driving motorcars. | | |

2. LANDSLIDES

There are no areas of landslide activity or significant hillside mass wasting on Fort Leonard Wood. Being a region of karst topography, however, some areas are subject to collapse of the soil overburden into solution cavities. Most of the cantonment area is considered to be on karst-type dolomite. Concentrations of sinkholes are located

in the general area between grid references 740670 and 780690, and within a 2-kilometer (1.25-mile) radius of grid reference 715760. Isolated sinkholes are at other locations on the reservation.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

ENGINEERING GEOLOGY

SOME ENGINEERING USES

1. Fine-grained dolomite with sandstone lenses.
2. Interbedded cherty and sandy dolomite and sandstone.
3. Fine- to coarse-grained non-sandy dolomite.

FEW ENGINEERING USES

4. Unconsolidated alluvial gravel, sand, and silt.
5. Unconsolidated colluvial deposits.

NOTE: Number refers to entry in table.

CONSTRUCTION MATERIALS

- Rock quarry (dolomite)
- Abandoned quarry (dolomite)
- Abandoned gravel pit

G. VEGETATION

Five vegetation types, forests, scrub, grasslands, agricultural lands and wetlands are significant to military training and operations at Fort Leonard Wood.

Forests comprise 79 percent of the vegetative cover on the reservation. Deciduous broadleaf is the principal forest type and approximately 85 percent of the dominant tree cover is the oak-hickory type found on the plateau and ridges. The remaining forest cover consists mainly of bottomland hardwoods found on the flood plains of the local streams and is dominated by sycamore, black walnut, American elm, silver maple and green ash. Evergreen needleleaf plantations account for 2.2 percent of the forests; species include shortleaf pine.

Scrub comprises 11 percent of the vegetative cover and is located predominately in the southern half of the reservation on abandoned agricultural fields and near training areas and range sites. The scrub cover consists of three types: (1) evergreen needleleaf with nearly open to medium spacing, dominated by shortleaf pine; (2) deciduous broadleaf with medium to dense spacing, dominated by oak, hickory and bottomland hardwood saplings plus sumac, coral berry, red cedar, poison ivy, blackberry, wild grape and Virginia creeper; and, (3) deciduous broadleaf scrub with nearly open to medium spacing dominated by similar species and mentioned in type number 2, but with a greater concentration of shrubs, vines, grasses and herbaceous species.

Grasslands comprise 8 percent of the vegetative cover. They are restricted in distribution to artillery and aerial gunnery ranges, other training areas or wildlife management areas. Average grass height is 1 to 1.5m (3 to 5 ft) for tall grasses and less than 1m (3 ft) for short grasses. Major species include broomsedge, little blue stem and Indian grass in the tall grasses and a variety of mixed grass species in the short grasses. Grassland vegetation is subject to range fires and prescribed burning.

Agricultural lands comprise 0.6 percent of the vegetative cover. One area located near the cantonment area is designated for garden use by base personnel. Three areas with consecutive rows of wildlife food plot strips are located in the reservation's northwestern corner. Firebreaks, maintained for wildlife management and individual wildlife food plot strips are located throughout the reservation, but are too small to map.

Wetlands comprise 0.1 percent of the vegetative cover. Located along a dammed lake just south of the cantonment area, this vegetation type is dominated by freshwater marsh grasses and sedges. Heights are generally 0.3 to 0.6m (1 to 2 ft).

Vegetation types which provide the optimum cover and concealment possibilities for foot troops and vehicles are the medium to dense stands of deciduous broadleaf forests and evergreen needleleaf plantations. Deciduous broadleaf forests provide excellent cover and concealment potential from early May through late October when the trees are in leaf; excellent cover and fair to poor concealment potential exists during the leafless season. Scrub can provide good concealment particularly for foot troops, year-round in evergreen needleleaf areas and seasonally in broadleaf deciduous areas. Vegetation types which provide the least cover and concealment possibilities include grasslands, agricultural lands and wetlands.

The location and extent of the significant vegetation types on Fort Leonard Wood are shown on the accompanying vegetation map. Descriptive details of each map unit are included in the table below.

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1. Evergreen needle-leaf trees; medium to dense spacing.	<p>Coniferous species make up 100 percent of each stand. These coniferous plantation areas contain shortleaf pines planted in rows between 1960 to 1970. Pine stem heights range from 4.5 to 9m (15 to 30 ft). Stem diameters range from 7.5 to 30cm (3 to 12 in). Crown cover density averages 60 percent. Tree spacing varies from 3 to 3.6m (10 to 12 ft). Branches begin 0.9 to 3m (3 to 10 ft) above ground level.</p> <p>Undergrowth is sparse to moderately dense, consists mainly of woody species, and in-cludes seedlings of the local major broadleaf deciduous forest. These species are post oak, blackjack oak, black oak, white oak and black hickory, plus sumac, coral berry and wild plum. Undergrowth height generally averages 0.9m (3 ft).</p>	<p>Covers 2.2 percent of the entire study area. The small scattered stands are located pre-dominately in the southern half of the reservation in abandoned agricultural fields.</p>	<p>This vegetation type is being managed for future harvesting which takes place after approximately 20 years of tree growth when pole size is obtained. Stands are thinned and selectively cut. Growth rates average 0.5m (1.5 ft) per year for height and 0.64cm (0.25 in) per year DBH (diameter at breast height). Seedlings were planted every 1.8m (6 ft) along rows spaced 3.6m (12 ft) apart.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is fair to poor.</p>	<p>Concealment for foot troops from aerial and ground observation is good to excellent year-round. Concealment of vehicles from aerial observation is fair to good year-round. Con-cealment of vehicles from ground observation is fair to poor year-round.</p>
2. Deciduous broad-leaf trees; medium to dense spacing.	<p>Deciduous species make up 95 percent of each stand. Three distinct forest types exist; flat uplands, hill uplands and bottomland hardwoods. Geomorphologically, flat upland forests are located on the plateau, while hill upland forests are found on the narrow ridge tops, convex slopes and footslopes. Bottom-land hardwood forests are located on the colluvial terraces and flood plains. These forest types contain the following dominant species respectively, post oak, blackjack oak, and black hickory; black oak, white oak, and northern red oak; and, sycamore, black walnut, American elm, silver maple and green ash. Stem heights average 15m (50 ft) in upland forests, and 21m (70 ft) in bottom-land hardwoods. Stem diameters range from 17.5 to 37.5cm (7 to 15 in) in upland forests, and 7.5 to 150cm (3 to 60 in) in bottomland hardwoods. Crown cover density is 70-100 percent for all forest types. Tree spacing varies from 1.5 to 12m (5 to 40 ft) for all forest types. Branches begin approximately 3m (10 ft) above ground level in the bottom-land hardwoods.</p> <p>Undergrowth is sparse to moderately dense in the upland forests. Saplings of the dominant tree species, dogwood and herbaceous plants are common undergrowth species. Under-growth heights average 1.8m (6 ft) or less. Undergrowth is dense in bottomland hard-woods. Wild grape, Virginia creeper, poison ivy and herbaceous plants are common undergrowth species. Undergrowth heights average 1.8m (6 ft) or less except for climbing vines.</p>	<p>Covers about 75 percent of the entire study area. The most common vegetation type throughout the reservation, these forests are related to elevation and slope aspects. Flat upland forests are located at the highest elevations, on the plateau, and on the southfacing slopes at lower elevations. Hill upland forests are located at moderate elevations on the tops of hills incised by streams, and on north-facing slopes. Bottomland hardwoods are located at the lowest elevations in the reservation. Located on the flood plains and terraces of the local streams, these forests are sub-ject to periodic flooding during the usu-ally wetter months of April to July and October.</p>	<p>This vegetation type includes the largest volume and densest timber growth on the reservation. Mature trees are harvested on an annual sus-tained yield basis for saw timber. Upland har-vested species include black oak, white oak, northern red oak and post oak. Bottomland harvested species include black walnut, syc-a-more and green ash. Continuous timber har-vesting on the reservation has produced a relatively homogeneous evenaged forest with an average age of 40 years. Only a few old growth (150-200 year old) stands exist. Very few exceptionally large trees exist, however, in 1976 a butternut (white walnut) received state champion tree status. (It is located at grid reference 682695).</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is excellent.</p>	<p>Foot-troop concealment is excellent from both aerial and ground observation when trees are in leaf (early May through late October). During the leafless season concealment for foot troops is fair to poor from both aerial and ground observation. Concealment for vehicles from aerial and ground observation during the period when trees are in leaf is excellent and generally fair to poor during the leafless season.</p>
3. Evergreen needleleaf scrub; nearly open to medium spacing.	<p>Coniferous species make up 100 percent of each stand. These coniferous plantation areas contain shortleaf pines planted in rows after 1970. Plant stem heights are less than 4.5m (15 ft). Stem diameters range from 2.5 to 7.5cm (1 to 3 in). Crown cover density averages 40 percent. Tree spacing varies from 1.8 to 3.6m (6 to 12 ft). Branches begin approximately 0.9m (3 ft) above ground level.</p> <p>Undergrowth is moderate to dense and con-sists of shrubby plants such as sumac, coral berry and blackberry; plus numerous grasses and other herbaceous plants.</p>	<p>Covers about 4 percent of the entire study area. The small scattered stands are located predominately in the southwestern quarter of the reservation in abandoned agricultural fields.</p>	<p>This vegetation type is being managed for future harvesting which will take place after approxi-mately 20 years of growth when pole size is obtained. Stands are subjected to prescribed burning for fire hazard reduction and elimi-nation of undesirable woody species. Seedlings were planted every 1.8m (6 ft) along rows spaced 3.6m (12 ft) apart.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is poor to nonexistent.</p>	<p>Concealment for foot troops from aerial and ground observation is fair to poor year-round. Concealment of vehicles from aerial and ground observation is poor.</p>
4. Deciduous broad-leaf scrub; medium to dense spacing.	<p>Deciduous species make up 95 percent or more of each stand with some red cedar inter-spersed. Tree species include post oak, black-jack oak and black hickory on plateau sites and on south facing slopes; black oak, white oak and northern red oak on ridge top sites and on north facing slopes; and, sycamore, black walnut, American elm, silver maple and green ash on flood plain sites. Stem heights are less than 4.5m (15 ft). Stem diameters range from 2.5 to 7.5cm (1 to 3 in). Crown cover density is 50 to 100 percent. Tree spacing varies from 0.3 to 1.8m (1 to 6 ft). Branches begin near the ground to 0.9m (3 ft) above ground level.</p> <p>Undergrowth is sparse to moderately dense. Upland sites contain small woody shrubs such as sumac and coral berry; vines such as poison ivy; brambles such as wild rose, blackberry and dewberry; plus grasses and other herbaceous species. Bottomland sites contain numerous vines, such as wild grape, Virginia creeper and poison ivy.</p>	<p>Covers about 3 percent of the entire study area. The relatively small stands are located predominately in the southern half of the reservation, in areas where previous timber harvesting and range fires prevailed.</p>	<p>This vegetation type has the same species composition as Unit 2, and is given com-plete protection on the reservation in order to promote maximum timber growth conditions. In bottomland sites, "tree release" (the clearing of growth away from prime harvestable species to reduce compe-tition and thus maximize growth) is prac-ticed for black walnut.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is poor to nonexistent.</p>	<p>When the trees are in leaf, concealment for foot troops from aerial and ground observation is fair to poor; during the leafless season con-cealment is nonexistent. Concealment for vehicles from aerial and ground observation is poor when trees are in leaf, nonexistent at other times.</p>

G. VEGETATION (Continued)

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
5. Deciduous broad-leaf scrubs; nearly open to medium spacing.	<p>Deciduous species make up 95 percent or more of each stand with some red cedar interspersed. Tree species include post oak, black-jack oak and black hickory on plateau sites and on south facing slopes; black oak, white oak and northern red oak on ridge top sites and on north facing slopes; and, sycamore, black walnut, American elm, silver maple and green ash on flood plain sites. Stem heights are less than 4.5m (15 ft). Stem diameters range from 2.5 to 7.5cm (1 to 3 in). Crown cover density is 10 to 50 percent. Tree spacing varies from 3 to 18m (10 to 60 ft). Branches begin near the ground to 0.9m (3 ft) above ground level.</p> <p>Undergrowth is moderate to dense. Upland sites contain small woody shrubs such as sumac and coral berry; brambles such as wild rose, blackberry and dewberry; plus, grasses such as broomsedge and numerous other herbaceous species such as red clover, horse nettle, beard tongue, common mullein, yarrow, ox-eye daisy, daisy fleabane, pale-purple coneflower, and common chickory. Bottomland sites contain small woody shrubs and numerous vines such as wild grape, Virginia creeper, and poison ivy; grasses such as bushy beardgrass and Kentucky bluegrass; and, other herbaceous species such as Solomon's seal, red clover, wild geranium, pale violet, smooth ruellia and golden ragwort.</p>	<p>Covers about 4 percent of the entire study area. The relatively small stands are located predominately in the southern half of the reservation in the impact areas and are frequently associated with firing and bombing ranges. Previous agricultural use, timber harvesting, prescribed burning, range fires and tree release practices are prime factors in maintaining these scrub areas.</p>	<p>This vegetation type has the same species composition as Units 2 and 4. This vegetation type and Unit 4 are earlier successional stages of Unit 2.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is nonexistent.</p>	<p>When the trees are in leaf, concealment for foot troops from aerial and ground observation is fair to poor; during the leafless season concealment is nonexistent. Concealment for vehicles from aerial and ground observation is poor to nonexistent.</p>
6. Tall grasses.	<p>Tall grasses consist of predominately broomsedge, little bluestem and Indian grass, mixed with several lesser important species. These grasses average 0.9 to 1.5m (3 to 5 ft).</p> <p>Shrubs interspersed in the grasslands include sumac and coral berry; brambles include wild rose, blackberry and dewberry; while, herbaceous species include red clover, horse nettle, beard tongue, common mullein, yarrow, ox-eye daisy, daisy fleabane and common chickory.</p>	<p>Covers about 3 percent of the entire study area. Scattered throughout the reservation, this vegetation type is frequently located near firing and bombing ranges and other training areas, or alongside stream banks.</p>	<p>Prescribed burning is occasionally practiced for fire hazard reduction, wildlife management, and to keep areas open for training sites. Impact areas are subject to range fires which burn off grassland vegetation at periodic intervals. This vegetation type is considered a potential future livestock forage resource.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is essentially nonexistent.</p>	<p>Concealment for foot troops from ground observation is fair year-round; concealment from aerial observation is nonexistent year-round. Concealment for vehicles from aerial and ground observation is nonexistent year-round.</p>
7. Short grasses.	<p>Short grasses consist of mixed species, including fescue, bluegrass, bluestem, redbtop, rye, oats, foxtail, crow'sfoot, crabgrass, broomsedge, quackgrass, Johnson grass and orchard grass. These grasses are less than 1m (3 ft) in height. Many are mowed or worn down by heavy use in training and firing range areas.</p>	<p>Covers about 6 percent of the entire study area. Located predominately in the central portion of the reservation just south of the cantonment area. Frequently located in heavily used areas, such as training areas, firing and bombing ranges, abandoned airstrips and the golf course.</p>	<p>Many areas are kept closely mowed. Grassy areas in the impact area are burned periodically for fire control. Some other small areas are also burned for wildlife habitat improvement.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is nonexistent.</p>	<p>Concealment for foot troops from ground observation is poor year-round; concealment from aerial observation is nonexistent year-round. Concealment for vehicles from aerial and ground observation is nonexistent year-round.</p>
8. Gardens and wild-life food plot strips.	<p>Fruits and vegetables are grown in the garden area. Heights are generally 0.2 to 1.8m (0.5 to 6 ft). On wildlife food plot strips a variety of grasses, grains and legumes such as wheat, rye, orchard grass, clover, vetch, and soybeans are grown for deer, turkey, quail and rabbit consumption. Heights are generally 0.2 to 0.9m (0.5 to 3ft).</p>	<p>Covers 0.6 percent of the entire study area. The one garden site is located near the cantonment area in the northeast portion of the reservation, south of Route 26 and across the road from the golf course. Three wildlife food plot strip areas are located in the northwest section of the reservation in abandoned agricultural fields.</p>	<p>The average growing season with frost free days extends from approximately April 14 to October 22. Agricultural lands on the reservation too small to map include individual wildlife food plot strips, and firebreaks maintained for wildlife management as well. These are about 10m (33 ft) wide.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is nonexistent.</p>	<p>Concealment for foot troops and vehicles from aerial and ground observation is nonexistent.</p>
9. Marshes; perennially wet.	<p>Freshwater marsh grasses and sedges make up this vegetation type. Heights are generally 0.9 to 1.5m (3 to 5 ft). Standing water depths are usually 0.3 to 0.6m (1 to 2 ft).</p>	<p>Covers 0.1 percent of the entire study area. The one site which exists is located in the northeast portion of the reservation, along the lake created by damming a tributary of the Big Piney River. (grid reference 767749/774746).</p>	<p>Used as waterfowl management site.</p>	<p>Cover for foot troops from flat-trajectory fire of small arms is nonexistent.</p>	<p>Concealment for foot troops and vehicles from aerial and ground observation is nonexistent.</p>

H. CLIMATE

The climate of the Fort Leonard Wood , Missouri area is classified as humid continental; seasons are well defined. Predominant climatic factors are its mid-latitude location in the Ozark Plateau which is influenced by warm moist air from the Gulf of Mexico, cold air from Canada and dry mild air from the Great Plains, and its mean annual precipitation of 1010.92 millimeters (39.80 inches) which may range from as little as 609.60 millimeters (24.00 inches) to as much as 1524.00 millimeters (60.00 inches).

Summers are warm, with daytime temperatures often ranging 32.2 to 37.2°C (90 to 99°F) during late June, July and August. The mean daily maximum temperatures for these months may reach 29.4 to 31.6°C (85 to 89°F) during the day and 17.2 to 18.8°C (63 to 66°F) at night. Temperatures greater than 32.2°C (90°F) occur an average of 38 days a year. The highest temperature on record was 45°C (113°F) in July 1954. About half the summer seasons have some days with temperatures over 37.8°C (100°F). A combination of uncomfortably high temperatures and humidity is likely for the one or more periods lasting up to a week or longer during the summer months. Such conditions may cause heat stress to unacclimatized personnel in strenuous training. Summer nights may be comparatively cooler, because of the elevation of the terrain. Even during the hottest summer months, there are some nights when temperatures may drop to between 10.0 and 17.2°C (50 and 63°F). Spring and fall temperatures are normally moderate and comfortable.

Winters are cold, but with frequent periods of mild weather. About two winters in three have temperatures below -17.8°C (0°F), but practically every winter has some daytime temperatures reaching 15.5 to 26.1°C (60 to 79°F) even during January and February. January, the coldest month, has a mean daily minimum temperature of -5°C (23.0°F). Polar air masses occasionally penetrate the area bringing below-freezing temperatures. The lowest temperature on record was -33.3°C (-28°F) in February 1899.

Precipitation is nonseasonal. More than half of the mean annual total can be expected to fall in the five month period from April through August. This is also the time of year when approximately two-thirds of the thunderstorms occur; an average of 59 storms occur a year. Heavy rains usually occur in April and May often causing flooding conditions. The mean monthly percipitation during the wettest month, May, is 136.91 millimeters

(5.39 inches); the driest month, January, has a mean monthly precipitation of 46.23 millimeters (1.82 inches). The maximum monthly precipitation on record was 424.18 millimeters (16.70 inches) in July 1873; the minimum monthly amount was a trace recorded in January 1919. The maximum 24-hour precipitation on record was 167.64 millimeters (6.60 inches) in January 1897.

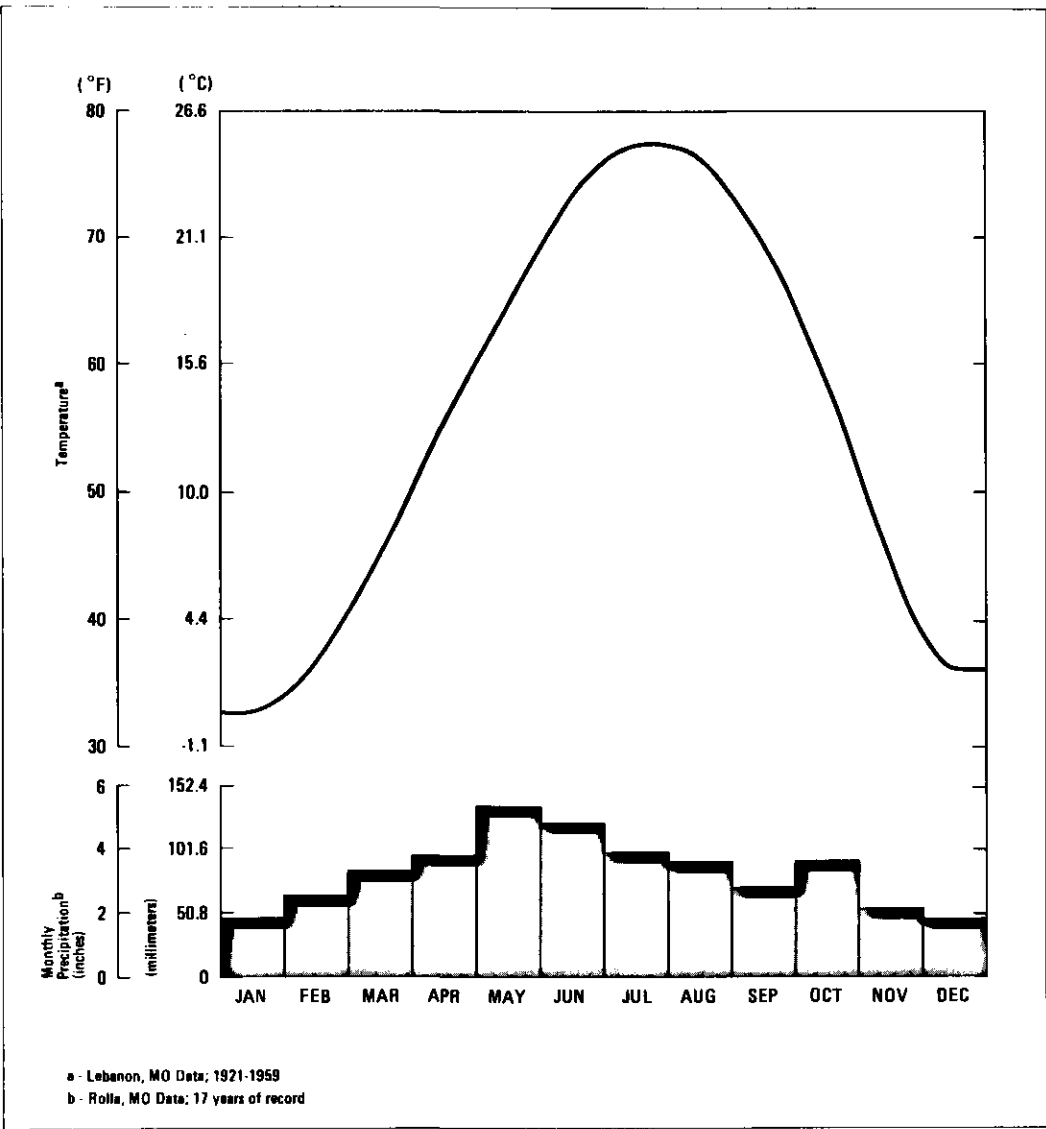
Some snow occurs every winter, but heavy amounts are unusual, and the snow rarely remains on the ground more than a few days. Snowfall averages 355.60 millimeters (14.00 inches) a year. Some winters have snow as early as November, but about half the winters do not have snow until December or January. Snow has been recorded as late as April, but this would occur only about one year in five. The last snow of the season usually occurs in March. The absolute maximum monthly snowfall on record was 558.80 millimeters (22.00 inches) in February 1912.

Prevailing winds are from the north at average speeds of 5.3 knots (9.8 kilometers per hour or 6.1 miles per hour); however, the strongest winds are usually associated with thunderstorms and are from the west or northwest. The “fastest-mile” sustained wind speed in the area was 57 knots, (106 kilometers per hour or 66 miles per hour) in May 1946. Tornadoes usually are associated with severe thunderstorms; winds within their spiraling vortex may exceed 300 knots (556 kilometers per hour or 345 miles per hour). Tornado frequency for this area is 10 to 30 occurrences per year.

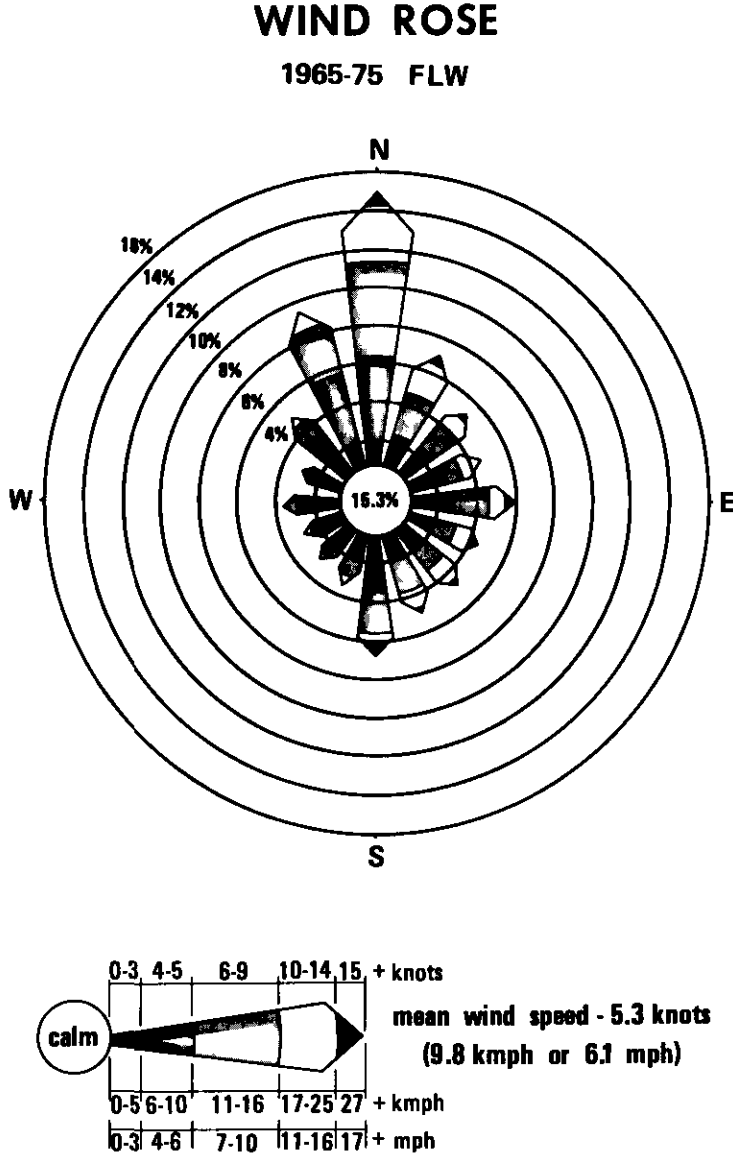
Since complete and long-record climatological observations do not exist for Fort Leonard Wood/Forney AAF, some of the data presented below are derived from U.S. Weather Service records at Rolla, Lebanon and Springfield, all of which are less than 112.6 kilometers (70 miles) from Fort Leonard Wood. Most of the data are from Rolla and Lebanon, each approximately 40.2 kilometers (25 miles) from the reservation. Rolla is northeast of Fort Leonard Wood, while Lebanon is located to the southwest. Similar conditions prevail at all of these sites.

See the table and diagrams below for climate and ephemeral data.

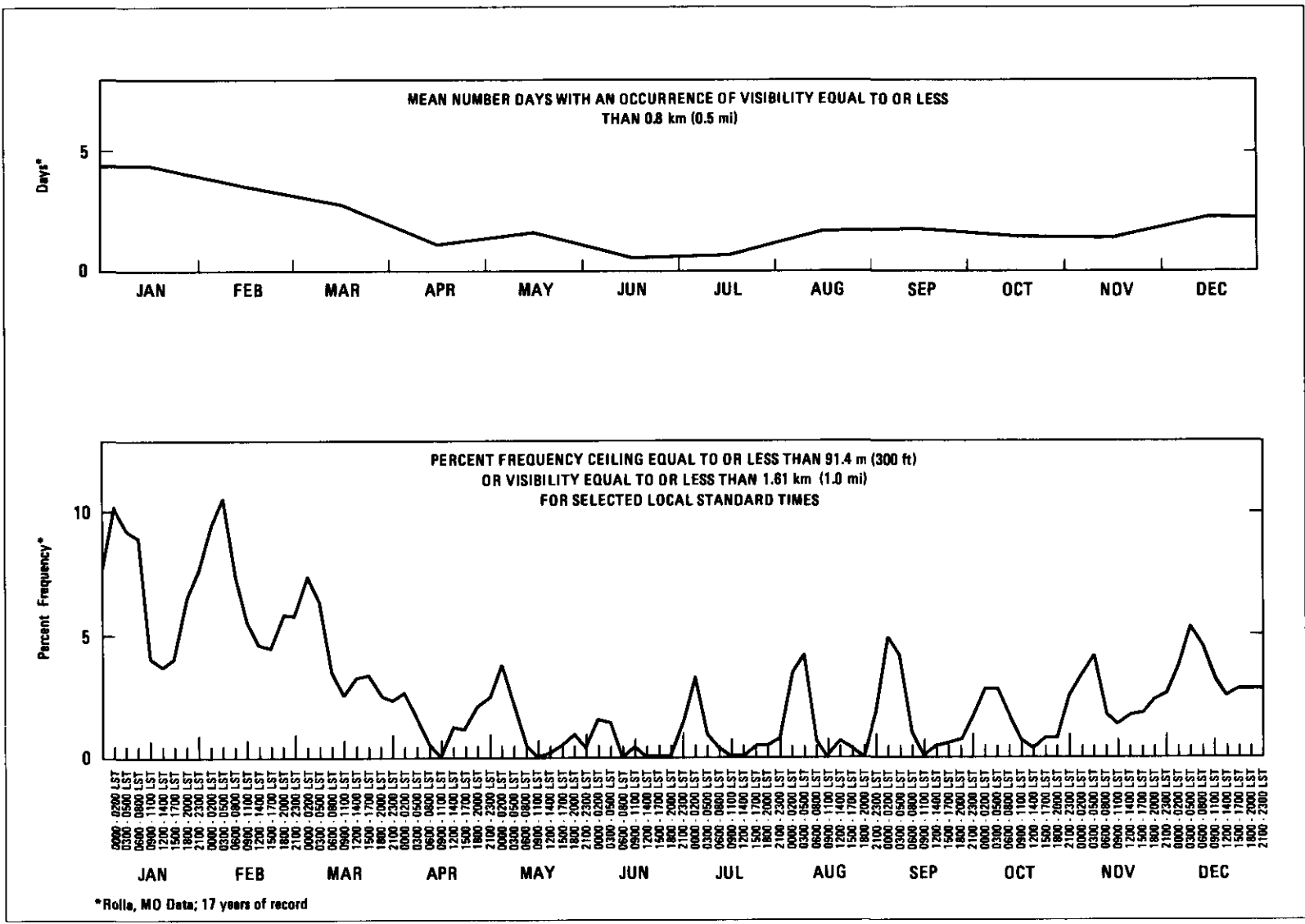
MEAN MONTHLY TEMPERATURE AND PRECIPITATION



WIND ROSE



VISIBILITY



CLIMATIC SUMMARY*

FORT LEONARD WOOD, MISSOURI FORNEY AAF LATITUDE 37° 44'N LONGITUDE 92° 08'W ELEVATION: 349m (1145 ft)															YEARS OF RECORD
PARAMETER DESCRIPTION	UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	
Absolute maximum temperature †	°C	26	28	32	34	38	41	45	43	40	35	30	27	45	60
	°F	79	82	90	93	101	105	113	110	104	95	86	80	113	60
Mean daily maximum temperature ‡	°C	5	8	12	19	24	29	31	31	27	21	12	7	19	17
	°F	41	46	53	66	75	84	88	87	80	70	54	44	66	17
Mean daily minimum temperature ‡	°C	-5	-3	0	7	12	18	19	19	14	9	1	-3	7	17
	°F	23	26	32	45	54	64	67	66	58	48	34	26	45	17
Absolute minimum temperature †	°C	-29	-33	-23	-13	-2	3	7	3	-2	-9	-17	-26	-33	60
	°F	-21	-28	-10	9	28	37	45	38	29	15	1	-15	-28	60
Mean number days with maximum temperatures ≥ 32.2°C (90°F) ‡	days	0	0	0	0	1.3	11.6	11.3	7.8	4.7	0.8	0	0	37.5	7
Mean number days with minimum temperatures ≤ 0.0°C (32°F) ‡	days	25.3	20.2	18.4	3.8	0.1	0	0	0	0	2.4	14.0	22.6	106.8	7
Normal heating degree days (base 18.3°C/65°F) †	days	980	784	661	278	105	12	0	6	45	212	576	887	4546	29
Normal cooling degree days (base 18.3°C/65°F) †	days	0	0	13	23	102	235	378	363	162	38	0	0	1334	29
Mean dew point temperature ‡	°C	-4	-2	-1	4	11	18	19	18	12	7	0	-3	7	7
	°F	25	28	31	40	52	64	66	65	54	45	32	26	44	7
Mean precipitation ‡	mm	46.23	62.23	85.34	95.50	136.91	122.68	98.81	92.96	72.90	93.22	56.39	46.48	1010.92	17
	in	1.82	2.45	3.36	3.76	5.39	4.83	3.89	3.66	2.87	3.67	2.22	1.83	39.80	17
Absolute maximum precipitation †	mm	236.98	152.40	255.02	334.52	346.71	392.68	424.18	314.71	381.76	351.28	212.34	306.58	424.18	60
	in	9.33	6.00	10.04	13.17	13.65	15.46	16.70	12.39	15.03	13.83	8.36	12.07	16.70	60
Absolute maximum 24 hour precipitation †	mm	167.64	61.47	74.93	88.90	142.24	148.59	101.60	119.63	109.22	101.60	93.98	152.40	167.64	60
	in	6.60	2.42	2.95	3.50	5.60	5.85	4.00	4.71	4.30	4.00	3.70	6.00	6.60	60
Absolute minimum precipitation †	mm	T	8.38	9.40	26.92	9.14	5.08	15.49	13.72	7.62	5.08	5.08	2.54	T	60
	in	T	0.33	0.37	1.06	0.36	0.20	0.61	0.54	0.30	0.20	0.20	0.10	T	60
Mean number days with precipitation ≥ 2.54mm (0.1 in) ‡	days	4.3	5.4	6.4	6.7	7.3	7.6	6.7	6.4	4.8	5.9	3.9	4.3	69.7	17
Mean number days with thunderstorms §	days	1	1	4	6	9	10	9	8	5	3	2	1	59	63
Mean snowfall ‡	mm	88.90	73.66	114.30	5.08	0	0	0	0	0	0	30.48	43.18	355.60	17
	in	3.5	2.9	4.5	0.2	0	0	0	0	0	0	1.2	1.7	14.0	17
Absolute maximum snowfall †	mm	513.08	558.80	241.30	304.80	50.80	0	0	0	0	152.40	203.20	279.40	558.80	60
	in	20.2	22.0	9.5	12.0	2.0	0	0	0	0	6.0	8.0	11.0	22.0	60
Maximum snow depth †	mm	152.40	254.00	254.00	76.20	0	0	0	0	0	0	431.80	152.40	431.80	23
	in	6.0	10.0	10.0	3.0	0	0	0	0	0	0	17.0	6.0	17.0	23
Mean number days with snowfall ≥ 28.1mm (1.0 in) §	days	1	1	1	#	0	0	0	0	0	0	#	1	5	35
Mean percent relative humidity ‡	%	74	71	67	62	68	70	71	73	66	65	64	71	69	7
Percent frequency of surface wind speed ≥ 28 knots (15.9 kmph or 32.24mph) ‡	%	0.1	0.2	0.8	0.3	0.1	0	0	0.1	0	0	0.2	0.3	0.2	7
Percent frequency of surface wind speed ≥ 17 knots (31.5 kmph or 19.58mph) ‡	%	7.3	9.3	15.1	10.7	3.6	2.0	0.7	0.5	2.0	1.9	7.5	8.4	5.8	7

H. CLIMATE (Continued)

CLIMATIC SUMMARY (Continued)*

FORT LEONARD WOOD, MISSOURI FORNEY AAF LATITUDE 37° 44'N LONGITUDE 92° 08'W ELEVATION: 349m (1145 ft)																
PARAMETER DESCRIPTION	UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD	
Fastest mile †	knots	46	51	50	52	57	50	49	51	47	43	49	48	57	13	
	mph	53	59	57	60	66	57	56	59	54	49	56	55	66	13	
	kmph	85	95	92	97	106	92	90	95	87	79	90	88	106	13	
Mean number days with surface wind ≥ 17 knots (31.5 kmph or 19.58 mph) and no precipitation ‡	(At 1800 LST)	2.4	2.5	4.4	1.7	1.1	0.4	0.1	0	0.1	0.3	1.6	2.1	16.7	7	
	(At 0000 LST)	1.7	2.4	2.5	1.8	0.1	0.7	0.1	0	0	0.3	0.9	2.1	12.6	7	
	(At 0600 LST)	0.9	1.7	3.6	1.3	0.7	0	0	0.1	0.1	0.1	1.1	2.2	11.8	7	
	(At 1200 LST)	3.8	3.9	7.8	5.2	2.4	1.0	0.7	0.3	1.1	1.8	4.2	4.2	36.4	7	
Mean number days with surface wind 4 to 10 knots (7.4 to 18.5 kmph or 4.61 to 11.52 mph) and temperature 0.6 to 31.7°C (33° to 89°F) and no precipitation ‡	(at 1800 LST)	8.2	10.8	16.0	15.8	22.0	18.9	19.3	18.5	19.1	21.0	16.0	12.6	198.2	7	
	(at 0000 LST)	6.0	9.0	10.8	17.9	21.8	23.0	23.3	23.5	22.6	22.5	15.6	9.8	205.8	7	
	(at 0600 LST)	4.3	6.0	8.0	16.4	20.7	22.4	23.2	23.3	21.9	23.0	12.5	6.7	188.4	7	
	(at 1200 LST)	8.0	9.3	11.8	12.7	18.1	15.3	16.2	19.1	16.7	17.7	11.1	9.8	165.8	7	
Mean number days with an occurrence of visibility ≤ 0.8km (0.5 mi) ‡	days	4.6	3.7	2.9	1.1	1.6	0.4	0.6	1.6	1.8	1.3	1.3	2.1	23.0	7	
Percent frequency ceiling ≤ 1524m (5000 ft) or visibility ≤ 8.05km (5 mi) ‡	%	37.2	35.0	33.1	24.7	17.7	12.1	14.3	11.3	14.6	16.5	20.5	34.0	22.6	7	
Percent frequency ceiling ≤ 457.2m (1500 ft) or visibility ≤ 4.83km (3 mi) ‡	(for 0000-0200 LST)	28.4	21.7	20.3	11.3	6.5	3.2	5.8	3.2	10.2	8.6	7.5	18.6	12.1	7	
	(for 0300-0500 LST)	31.6	26.8	23.7	13.8	11.5	6.5	8.6	8.0	12.5	10.3	8.7	22.7	15.4	7	
	(for 0600-0800 LST)	30.1	31.2	24.0	15.6	14.1	8.1	11.1	11.7	13.2	11.5	11.7	23.8	17.2	7	
	(for 0900-1100 LST)	30.3	30.8	21.1	12.2	8.3	6.5	7.5	7.4	11.6	9.5	11.6	23.1	15.0	7	
	(for 1200-1400 LST)	26.2	26.0	19.1	8.4	4.6	3.7	2.3	3.2	6.5	8.0	10.8	18.5	11.4	7	
	(for 1500-1700 LST)	21.8	21.1	16.3	8.4	3.9	1.4	1.5	2.8	4.3	6.8	7.5	17.0	9.4	7	
	(for 1800-2000 LST)	20.8	18.5	17.2	8.6	4.0	2.4	1.5	2.2	5.9	6.9	7.5	16.4	9.3	7	
	(for 2100-2300 LST)	25.2	19.4	19.2	11.5	7.1	2.5	2.0	2.3	7.0	8.8	7.6	17.4	10.8	7	
Percent frequency ceiling ≤ 91.4m (300 ft) or visibility ≤ 1.61km (1 mi) ‡	(for 0000-0200 LST)	7.7	7.7	5.8	2.2	2.3	0.2	1.2	0.6	1.9	1.4	2.4	2.5	3.0	7	
	(for 0300-0500 LST)	10.1	9.4	7.5	2.5	3.8	1.4	3.2	3.4	4.9	2.8	3.2	3.6	4.7	7	
	(for 0600-0800 LST)	9.2	10.6	6.3	1.6	2.0	1.3	0.8	4.1	4.1	2.8	4.0	5.1	4.3	7	
	(for 0900-1100 LST)	8.0	7.4	3.6	0.6	0.3	0	0.2	0.5	0.8	1.5	1.6	4.3	2.4	7	
	(for 1200-1400 LST)	4.0	5.6	2.5	0	0	0.2	0	0	0	0.5	1.1	3.1	1.4	7	
	(for 1500-1700 LST)	3.8	4.6	3.1	1.1	0	0	0	0.5	0.2	0.3	1.6	2.5	1.5	7	
	(for 1800-2000 LST)	4.0	4.5	3.2	1.0	0.3	0	0.2	0.2	0.3	0.6	1.7	2.8	1.6	7	
	(for 2100-2300 LST)	6.5	5.9	2.6	1.9	0.8	0	0.2	0	0.6	0.6	2.1	2.8	2.0	7	
Mean number of days with sky cover ≤ 30 percent and visibility ≥ 4.83km (3 mi) ‡	(at 1800 LST)	9.1	11.5	8.7	7.6	11.6	11.9	10.0	13.0	15.8	15.4	14.3	10.8	139.7	7	
	(at 0000 LST)	11.5	11.9	14.3	14.0	17.3	17.9	17.9	20.1	19.6	20.6	17.4	13.9	196.4	7	
	(at 0600 LST)	9.8	11.5	10.3	10.1	9.0	10.1	10.1	11.7	15.6	16.6	13.3	10.8	138.9	7	
	(at 1200 LST)	6.5	8.6	7.4	7.4	6.9	6.4	5.1	7.7	12.8	14.0	10.8	8.3	101.9	7	
Mean number days with ceiling ≥ 304.8m (1000 ft) and visibility ≥ 4.83km (3 mi) ‡	(at 1800 LST)	26.0	23.9	26.8	28.0	30.3	29.9	30.6	30.4	29.0	29.5	28.1	27.1	339.6	7	
	(at 0000 LST)	24.3	23.3	25.5	27.1	29.5	29.4	30.0	30.3	27.4	28.8	28.1	26.5	330.2	7	
	(at 0600 LST)	23.7	21.1	25.5	27.1	27.7	28.3	28.1	27.4	26.6	28.3	27.1	26.3	317.2	7	
	(at 1200 LST)	24.4	22.5	26.4	28.7	30.4	29.4	30.6	29.9	28.8	28.7	27.8	27.0	334.6	7	
Mean number days with ceiling ≥ 609.6m (2000 ft) and visibility ≥ 4.83km (3 mi) and surface wind ≤ 10 knots (18.5 kmph or 11.5 mph) ‡	(at 1800 LST)	14.0	14.3	13.1	14.0	22.0	22.6	26.0	28.3	26.0	24.8	19.3	15.2	239.6	7	
	(at 0000 LST)	9.7	11.3	13.4	16.4	24.1	24.0	26.4	27.6	22.8	21.1	17.4	12.6	226.8	7	
	(at 0600 LST)	9.4	9.6	12.3	14.4	20.1	22.1	22.6	24.4	20.1	20.8	16.1	12.3	204.2	7	
	(at 1200 LST)	10.4	7.8	8.3	10.1	15.6	16.7	20.7	23.1	16.3	16.6	10.4	10.4	166.4	7	
Mean number days with ceiling ≥ 762.0m (2500 ft) and visibility ≥ 4.83 (3 mi) ‡	(at 1800 LST)	22.3	20.9	24.4	26.6	29.3	28.8	30.4	30.3	27.4	28.6	26.7	24.0	319.7	7	
	(at 0000 LST)	21.0	20.8	23.4	25.1	28.7	29.3	29.1	30.1	26.9	27.4	27.3	23.5	312.6	7	
	(at 0600 LST)	20.6	18.8	22.3	24.1	26.3	27.1	26.6	26.6	25.7	27.0	25.3	21.4	291.8	7	
	(at 1200 LST)	19.8	18.8	23.7	25.1	27.3	27.3	28.0	28.7	26.6	27.6	25.3	22.2	300.4	7	
Mean number days with ceiling ≥ 1828.8m (6000 ft) and visibility ≥ 4.83km (3 mi) ‡	(at 1800 LST)	20.3	19.5	20.8	23.6	26.8	27.3	28.4	29.5	26.7	25.5	24.1	20.8	293.3	7	
	(at 0000 LST)	19.3	18.8	21.0	23.1	27.3	28.1	28.0	29.0	26.3	26.4	24.6	21.1	293.0	7	
	(at 0600 LST)	18.7	16.7	19.3	22.0	24.0	25.1	24.8	25.4	25.3	25.5	23.1	19.1	269.0	7	
	(at 1200 LST)	18.7	17.4	19.4	21.0	23.4	23.4	23.7	26.0	25.6	24.8	21.8	19.4	264.6	7	
Mean number days with ceiling ≥ 3048.0m (10,000 ft) and visibility ≥ 4.83 (3 mi) ‡	(at 1800 LST)	19.1	18.4	19.4	21.8	24.8	26.1	26.7	28.6	25.4	24.7	22.8	20.1	277.9	7	
	(at 0000 LST)	18.6	17.7	19.7	22.1	25.9	27.4	27.0	27.4	25.6	25.5	23.3	20.4	280.6	7	
	(at 0600 LST)	17.0	16.0	18.6	19.7	22.3	23.3	23.0	23.1	23.6	24.1	21.7	17.1	249.5	7	
	(at 1200 LST)	17.4	16.7	17.3	18.8	21.9	21.6	23.3	24.0	25.3	23.7	20.6	17.9	248.5	7	
Mean pressure altitude ‡	m	293.5	293.2	319.7	330.4	339.2	343.2	334.1	333.8	317.9	307.8	304.5	295.4	317.6	No data	
	ft	963	962	1049	1084	1113	1126	1096	1095	1043	1010	999	969	1042	No data	

*Note: # = Less than 0.5 day; LST = Local Standard Time; T = Trace.

† Data derived from records at Lebanon (1921 to 1970, latitude 37° 41'N, longitude 92° 40'W, elevation 381.0m (1250 ft)).

‡ Data derived from records at Rolla (1931 to 1960, latitude 37° 57'N, longitude 91° 46'W, elevation 366.4m (1202 ft)).

§ Date derived from records at Springfield (1941 to 1970, latitude 37° 14'N, longitude 93° 23'W, elevation 386.5m (1268 ft)).

EPHEMERIS FOR FORT LEONARD WOOD, MISSOURI
(CENTRAL STANDARD TIME)

NAUTICAL TWILIGHT					NAUTICAL TWILIGHT					NAUTICAL TWILIGHT					NAUTICAL TWILIGHT				
DATE	BEGINNING	END	SUNRISE	SUNSET	DATE	BEGINNING	END	SUNRISE	SUNSET	DATE	BEGINNING	END	SUNRISE	SUNSET	DATE	BEGINNING	END	SUNRISE	SUNSET
January 1	0622	1803	0724	1700	April 1	0457	1929	0554	1831	July 1	0340	2044	0450	1934	October 1	0507	1849	0604	1752
January 11	0623	1811	0724	1709	April 11	0441	1939	0540	1840	July 11	0347	2041	0456	1932	October 11	0516	1834	0613	1737
January 21	0620	1820	0720	1720	April 21	0425	1950	0526	1849	July 21	0356	2033	0503	1927	October 21	0525	1821	0622	1724
February 1	0614	1831	0713	1732	May 1	0411	2001	0513	1859	August 1	0407	2022	0512	1917	November 1	0535	1808	0634	1710
February 11	0605	1841	0703	1743	May 11	0358	2012	0503	1908	August 11	0418	2009	0520	1907	November 11	0545	1800	0644	1701
February 21	0554	1851	0651	1754	May 21	0348	2023	0454	1916	August 21	0428	1954	0529	1854	November 21	0554	1754	0655	1654
March 1	0544	1859	0641	1802	June 1	0340	2033	0448	1924	September 1	0439	1937	0538	1838	December 1	0604	1751	0705	1650
March 11	0530	1908	0626	1812	June 11	0336	2040	0446	1930	September 11	0449	1921	0547	1823	December 11	0612	1752	0714	1650
March 21	0514	1918	0611	1821	June 21	0336	2044	0447	1934	September 21	0458	1904	0555	1808	December 21	0618	1756	0720	1653

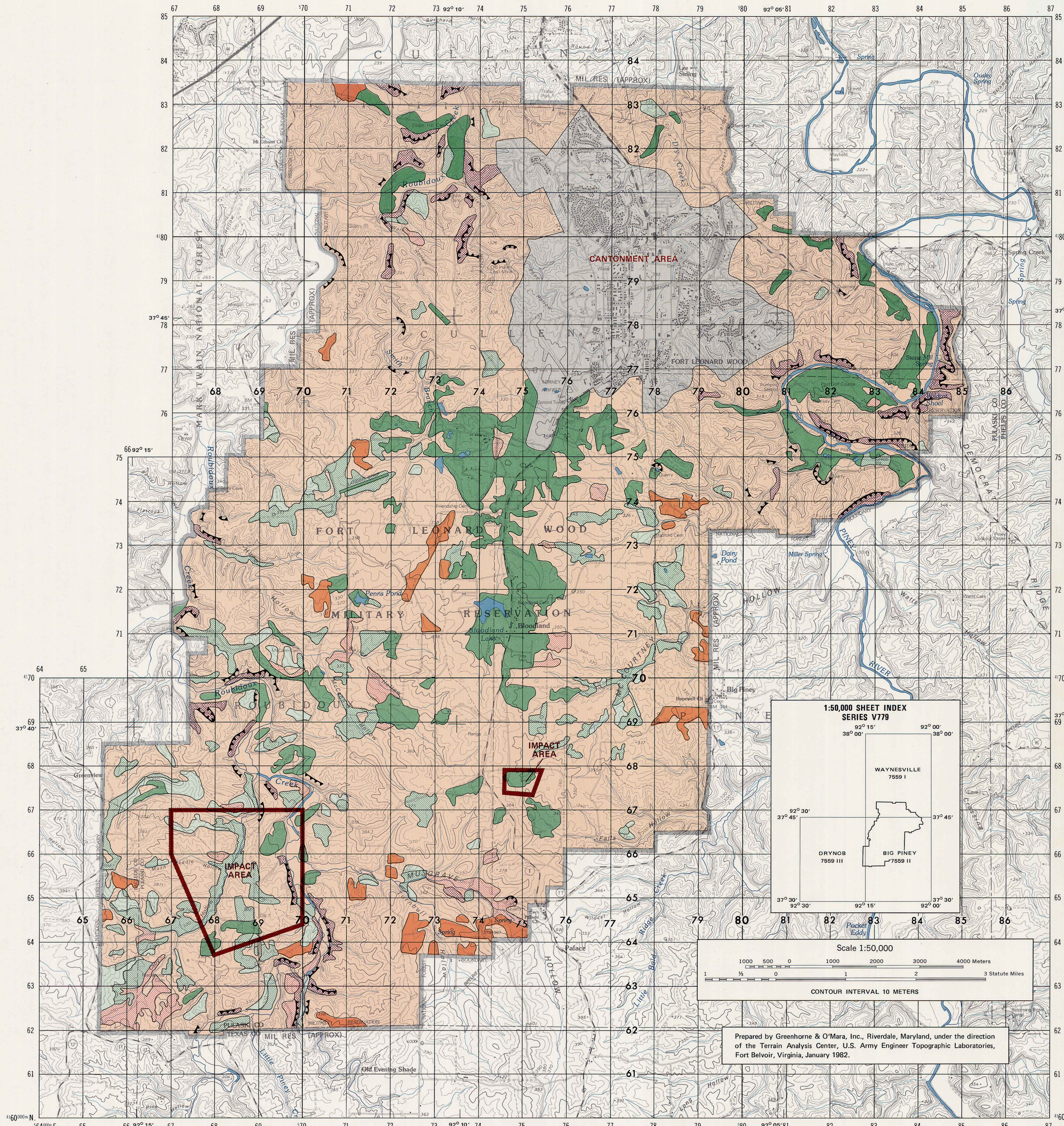
I. CROSS-COUNTRY MOVEMENT

MAP UNIT	GENERAL TERRAIN CONDITIONS*	MOVEMENT OF TRACKED VEHICLES†	MOVEMENT OF WHEELED VEHICLES‡	MOVEMENT OF FOOT TROOPS
1. Nearly level to gently rolling grasslands and open areas.	<p>Nearly level to gently rolling grasslands and open areas scattered throughout the reservation, one large area occupying the center of the reservation from the cantonment area to about 2km (1.22 mi) south of Bloodland. Slopes are mostly less than 8 percent; some slopes may locally exceed 15 percent. Vegetation consists mainly of short grass, but some areas of tall grass up to 1.5m (5 ft) high are located primarily on the flood plains of Big Piney River and Roubidoux Creek. Soils consist primarily of silt loams and silty clay loams of varying characteristics. These soils have good bearing strength when dry, but generally become slippery when wet. See Section D, Engineering Soils, for assessment of soil trafficability. Streams are narrow, shallow, and mostly intermittent.</p> <p>Manmade features to be avoided are: built-up areas at grid references 740755 and 748712, unfenced sewage lagoons at grid reference 738752; lakes and sedimentation ponds at grid references 742717, 713718, 732755, 736750, 737751, and 741752. Sinkholes in grid square 7275 should be avoided.</p>	<p>Movement generally easy in any direction. Clayey soils slow movement during wet periods, particularly during December through April. Occasional flooding locally may present obstacles, especially in major stream flood plains.</p>	<p>Movement generally easy in any direction, although clayey soils slow movement when wet. Local flooding may present obstacles, especially in Roubidoux Creek and Big Piney River flood plains.</p>	<p>Movement generally unhindered in any direction, but may be slightly slowed in tall grass. Occasional flooding of major stream flood plains may temporarily prohibit movement.</p>
2. Nearly level to gently rolling grasslands and scrub-covered plains.	<p>Nearly level to gently rolling, scrub-covered plains with open to medium spacing scattered primarily through the western and southwestern portions of the reservation. Most slopes are less than 8 percent; some slopes are locally as high as 15 percent. Vegetation consists of young coniferous plantations with trees planted in rows, and areas of deciduous broadleaf scrub. Stem diameters range from 2.5 to 7.5cm (1 to 3 in). Tree spacing ranges from 1.8 to 3.6m (6 to 12 ft) in the coniferous plantations, and from 3 to 18m (10 to 60 ft) in the deciduous areas. Undergrowth is moderate to dense. Streams are narrow and shallow, but crossing may be difficult after heavy rains.</p> <p>Sedimentation pond at grid reference 765728 should be avoided.</p>	<p>Movement somewhat slowed by woody vegetation; trees generally can be pushed over or maneuvered around. Clayey soils are an additional hindrance on the steeper slopes during wet periods. Occasionally flooding limits local movement, especially in the Roubidoux Creek flood plain.</p>	<p>Movement generally easy in any direction for 2½-ton trucks by by-passing or pushing over vegetation. Movement of ¼-ton trucks may be more difficult through areas of more closely spaced trees with greater stem diameters which cannot be pushed over. Clayey soils slow movement when wet. Occasional flooding restricts local movement at stream crossings.</p>	<p>Movement slightly slowed in areas of more open spacing and moderate undergrowth, and more difficult through dense undergrowth.</p>
3. Moderately sloping, scrub-covered uplands.	<p>Moderately sloping, scrub-covered uplands consisting of small patches principally in the southern half of the reservation. Slopes normally range from 8 to 30 percent, but locally may exceed 45 percent. Vegetation consists of young coniferous trees planted in rows, and nearly open to densely spaced deciduous broadleaf scrub. Stem diameters range from 2.5 to 7.5cm (1 to 3 in). Tree spacing generally varies from 1.8 to 18m (6 to 60 ft), with some areas of denser spacing. Undergrowth is sparse to dense. Streams range in width from 10 to 15m (33 to 49 ft), and are intermittent; some stream valleys have moderately steep, eroded walls.</p>	<p>Movement somewhat slowed by dense woody vegetation; trees generally can be pushed over or maneuvered around. Steep stream valleys and severely eroded areas should be avoided.</p>	<p>Moderate slopes impede movement, particularly when soils are wet. Densely spaced vegetation must be avoided; coniferous plantations may channel movement. Steep and eroded stream valley walls must be avoided; occasional local flooding may impede use of crossing sites.</p>	<p>Movement slightly slowed in areas of open spacing and moderate undergrowth, and more difficult with increasing slope and dense undergrowth. Areas of dense scrub should be avoided. Severe erosion in some areas could hinder movement. Wet soils and swift stream currents after heavy rains are additional constraints.</p>
4. Nearly level to gently rolling plains; medium to densely wooded coniferous plantations.	<p>Nearly level to gently rolling plains; medium to densely wooded coniferous plantations at various locations, primarily in the southern half of the reservation. Slopes are mostly less than 8 percent, but may locally be as much as 15 percent. Vegetation consists of shortleaf pine planted in rows prior to 1970. Stem diameters range from 7.5 to 30cm (3 to 12 in), and tree spacing varies from 3 to 3.6m (10 to 12 ft). Undergrowth is sparse to moderately dense, and consists of deciduous broadleaf seedlings up to 0.9m (3 ft) high. Streams are few and generally pose no impediment to movement except after heavy rainfall.</p>	<p>Tank movement considerably slowed by dense vegetation. APC movement is easier, but may be channeled by rows of trees. Occasional flooding limits local movement, especially in Roubidoux Creek flood plain.</p>	<p>Movement of 2½-ton trucks restricted to direction of coniferous plantation rows. Tree spacing permits easier maneuvering of ¼-ton trucks. Occasional flooding in Roubidoux Creek flood plain limits movement.</p>	<p>Movement generally easy in areas of sparse undergrowth, slightly slowed in areas of moderately dense woody undergrowth.</p>
5. Nearly level to gently rolling, densely scrub-covered plains.	<p>Nearly level to gently rolling, scrub-covered plain with dense spacing, located principally in the southwestern portion of the reservation. Most slopes are less than 8 percent; some slopes are as high as 15 percent. Vegetation consists of deciduous broadleaf scrub, mainly oak and hickory. Stem diameters range from 2.5 to 7.5cm (1 to 3 in). Tree spacing ranges from 0.3 to 1.8m (1 to 6 ft) with sparse to moderately dense undergrowth. Streams are normally narrow and shallow, but may locally have steep banks and vary in width.</p>	<p>Movement somewhat slowed by dense woody vegetation; trees can generally be pushed over. Clayey soils are a hindrance on the steeper slopes during wet periods.</p>	<p>Dense vegetation severely hinders movement. Locally steep stream banks and occasional flooding of crossing sites are additional impediments to movement.</p>	<p>Movement hindered by dense scrub and undergrowth. Some steep stream banks and occasional flooding are additional constraints.</p>
6. Nearly level to moderately sloping; medium to densely forested areas.	<p>Nearly level to moderately sloping areas of medium to dense forest occupying most of the reservation. Slopes vary from nearly level to 30 percent, but locally may exceed 100 percent. All terrain types on Fort Leonard Wood are represented: level uplands, ridges and sideslopes, and bottomlands. The vegetation consists of deciduous broadleaf trees, including oak, hickory, maple, ash, elm, sycamore, and walnut. Stem diameters range from 17.5 to 37.5cm (7 to 15 in) in the uplands, and from 7.5 to 150cm (3 to 60 in) in the bottomlands. Tree spacing varies from 1.5 to 12m (5 to 40 ft). Undergrowth is sparse to moderately dense in the uplands, and is dense in the bottomlands. Most streams are intermittent, ranging from narrow and shallow to moderately wide and deeply incised. A small area of perennially wet marsh about 200m (660 ft) wide extends from grid references 767749 to 773746.</p> <p>Manmade features which may be impediments to movement are: railroad from the cantonment area to the northern boundary of the reservation, and built-up areas at grid references 783824, 770763, 774767, 728699 and 732692. Areas to be avoided are: unfenced sewage lagoons at grid reference 784824, sedimentation ponds at grid references 732762 and 731748.</p>	<p>Movement severely slowed by randomly spaced trees. Clayey soils could be a hindrance on steeper slopes during wet periods. Visibility moderately impaired by undergrowth. Occasional flooding locally may present obstacles, particularly in major stream flood plains. Severe erosion in some areas could hinder movement.</p>	<p>Combination of steep slopes and closely spaced trees locally unsuitable for wheeled vehicle movement. Movement moderately to severely hindered in other areas depending on density of vegetation, slope, and soil moisture. Deeply incised streams must be avoided. Occasional flooding, particularly on flood plains of major streams, presents additional impediments to movement.</p>	<p>Movement slightly slowed in areas of moderate tree spacing and sparse undergrowth, becoming more difficult with increasing slope and dense undergrowth. Swift currents after intense rainfall render some deeply incised streams impassable.</p>
7. Moderately to steeply sloping; forested valley sides, and escarpments.	<p>Moderately to steeply sloping terrain, forested valley sides, and escarpments, mainly along the valley walls and major intermittent tributaries of the Big Piney River and Roubidoux Creek. Most slopes range between 30 to 45 percent, but locally may exceed 100 percent. Vegetation consists of deciduous broadleaf trees of medium to dense spacing. Stem diameters range from 17.5 to 37.5cm (7 to 15 in). Tree spacing ranges from 1.5 to 12m (5 to 40 ft) with sparse to moderately dense undergrowth. Streams are intermittent, have steep gradients and steep, eroded walls.</p>	<p>Movement severely hindered to prohibited, depending on slope, tree spacing, and escarpments. Soil wetness during periods of heavy rain is an additional impediment to movement. Visibility moderately impaired by undergrowth.</p>	<p>Movement not practical because of steep slopes and escarpments.</p>	<p>Movement hindered significantly by steep slopes, dense undergrowth, and escarpments. Wet soils after heavy rains are additional impediments.</p>

*Movement conditions will be degraded for a day or two following heavy rains. Soils dry fairly quickly after a rain due to rapid runoff, moderate permeability, and fairly high evapotranspiration rate. Flooding normally occurs February through June with the heaviest rains resulting from thunderstorms in April and May. Heavy rains from thunderstorms continue into August and may cause flooding. Precipitation is lower in winter, but perched water table in some areas during December through March lowers soil bearing strength. Snow at Fort Leonard Wood is seldom a factor in cross-country movement.

†Comments apply to the M-60 tank and the M-113 armored personnel carrier.

‡Comments apply to the M-35, 2½-ton truck and the M-151, ¼-ton truck.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

CROSS COUNTRY MOVEMENT

EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

This map deals with cross-country movement, or movement away from roads, and is primarily intended for use in planning operations. To determine exact driving routes, field reconnaissance is required. The evaluations are generalized to suit the scale of the map; many areas of minor areal extent, such as small tracts of forest, cleared areas, or built-up training support areas, are too small to portray. Areas with a gray tint represent built-up areas and are not evaluated.

Predicted movement ratings prevail in most years. Variations in these evaluations may occur from year to year and even within a season due to abnormal variations in weather. The evaluations are based on terrain conditions as they are at present. Future alterations of the terrain, such as timber clearing operations, growth progression in coniferous plantations, artificial drainage, and road construction, will change cross-country movement conditions. See Section L, Non-Urban Culture Features, for manmade features which will affect movement.

Movement conditions will be degraded for a day or two following heavy rains. Soils dry fairly quickly after a rain due to rapid runoff, moderate permeability, and fairly high evapotranspiration rate. Flooding normally occurs February through June with the heaviest rains resulting from thunderstorms in April and May. Heavy rains from thunderstorms continue into August and may cause flooding. Precipitation is lower in winter, but perched water table in some areas during December through March lowers soil bearing strength. Snow at Fort Leonard Wood is seldom a factor in cross-country movement.

- 1. Nearly level to gently rolling grasslands and open areas.
- 2. Nearly level to gently rolling scrub-covered plains.
- 3. Moderately sloping scrub-covered uplands.
- 4. Nearly level to gently rolling plains; medium to densely wooded coniferous plantations.
- 5. Nearly level to gently rolling, densely scrub-covered plains.
- 6. Nearly level to moderately sloping, medium to dense forest.
- 7. Moderately to strongly sloping forested valley walls and escarpments.

NOTE: Number refers to entry in table.

PREDICTED MOVEMENT RATINGS FOR:

TANK (M-60)	APC (M-113)	2½-TON TRUCK (M-35)	¼-TON TRUCK (M-151)	FOOT TROOPS
Good	Good	Good	Good	Good
Good	Good	Good	Fair	Fair
Fair	Fair	Poor	Poor	Fair
Poor	Fair	Poor	Fair	Fair
Fair	Fair	Poor	Poor	Poor
Poor	Poor	Poor	Poor	Fair
Poor	Poor	Unsuitable	Unsuitable	Poor

EXPLANATION OF RATING TERMS

- Good: Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, sharp turns, or crossing of tracks) at one location.
- Fair: Conditions moderately hinder progress or moderately restrict choices of direction for movement. Terrain will permit 3 to 12 passes in trace of an M-60 but maneuvering will be difficult.
- Poor: Conditions severely hinder progress or greatly restrict choice of movement routes. Terrain will probably permit up to 3 passes in trace of an M-60. Very cautious driving required. Movement in trace should be avoided.
- Unsuitable: Conditions preclude all but local movement. Engineer work required for vehicular movement.

- Impact area: off-limits to vehicles and foot troops due to the danger of unexploded munitions.
- Escarpment (slope >100%). Barbs point downslope.

J. LINES OF COMMUNICATION

INTRODUCTION

Lines of Communication at Fort Leonard Wood are depicted on the accompanying map. Supporting information is provided in the tables following this summary.

ROADS

Over 458 kilometers (284 miles) of the roads on Fort Leonard Wood are delineated on the Lines of Communication map. These roads include 161 kilometers (100 miles) of paved roads, 89 kilometers (55 miles) of loose-surface roads, and 208 kilometers (129 miles) of improved and unimproved dirt roads. Major through routes in the cantonment area and roads outside the cantonment area were selected to represent road patterns providing access to most features on the reservation.

Most improved and unimproved dirt roads have a sand, gravel, and chert composition providing generally good surface conditions. Erosion and washouts are a significant problem with regular maintenance required. Loose-surface roads are those which have limestone or gravel aggregates applied regularly and are classified by the facilities engineer as primarily all-weather roads. Shoulders on both the dirt and loose-surface roads are generally absent or undefined.

Primary access to Fort Leonard Wood is provided by Interstate 44 Spur (Missouri Avenue) at the north entrance and State Highway AW (Route I) at the south entrance. Secondary access is provided by State Highways 17, H, TT, and FLW Route 10.

There are 15 bridges [including culverts greater than 6.1 meters (20 feet) in length] and 44 fords on the reservation. Fords are described in Section B, Surface Drainage.

RAILROADS

The Fort Leonard Wood rail system, built in 1941, consists of approximately 43 kilometers (27 miles) of U.S. Government-owned track, but only about 13 kilometers (8 miles) are on the reservation. The remaining 30 kilometers (19 miles) connect the installation with the Burlington Northern railroad (formerly the St. Louis-San Francisco Railroad) at Bundy Junction. The main trackage serves the Fort Leonard Wood classification yard at the eastern edge of the cantonment area which contains warehouse storage, outloading, fuel, and maintenance facilities. (See the Railroad Sidings Enlargement under Section 2, Railroads). The main track characteristics include 70 curves with a maximum curvature of 8 degrees; a maximum grade of 2 degrees 31 minutes; fourteen trestles, the longest 537 meters (1761 feet); two steel bridges over the Big Piney River and Little Piney River; and a speed limit of 40 kilometers per hour (25 miles per hour).

The Fort Leonard Wood rail system is maintained in good condition and meets federal track safety standards for Class 2 or better.

Currently, rail operations average less than 10 railcars per month at Fort Leonard Wood. However, it is estimated that the existing rail system could outload approximately 200 railcars per day, if required. Rail operations primarily involve heavy equipment transport with some clothing and textile shipments. Rail load planning and out-loading exercises are conducted periodically by base personnel.

AIRFIELDS

Fort Leonard Wood has one airfield, Forney Army Airfield; the entire airfield complex is within the cantonment area. The airfield is used by both fixed-wing and rotary-wing aircraft. The post maintains a small contingent of rotary-wing aircraft. There is one paved runway in good condition which can accommodate C-130 and C-141 type aircraft on a limited landing-cycle basis. Four abandoned airstrips are on the reservation outside of the cantonment area and are identified in Section L, Non-Urban Culture Features.

HELICOPTER LANDING ZONES

Fort Leonard Wood has only one primary helicopter landing zone, Forney Army Airfield. One other hardened landing zone at Cannon Range 50 and several undefined open areas are available for helicopter landings in conjunction with base training programs and by Army Reserve and Air National Guard units. Helicopters use the main runway for takeoffs and landings. Helicopter parking areas are along and south of the main apron and on designated grassy areas southeast of the runway. A future helipad is planned east of the hospital to provide emergency medical airlift transportation.

DROP ZONES

Fort Leonard Wood has no officially designated drop zones. However, drop exercises have been conducted in the past along the emergency landing strip south of the Forney Army Airfield runway, including the area south of the parking apron known as "South Sod" (grid squares 7576 and 7575).

1. ROADS

ROUTE NUMBER / NAME	ROUTE LOCATION (GRID REFERENCE)		LENGTH OF SEGMENT		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS
	FROM	TO	km	(mi)			CONSTRUCTION MATERIALS	WIDTH / CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH / CONDITION m (ft)	
Alabama Avenue	769797	770769	2.9	(1.8)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	1.2 (4)/good	
Army Avenue	783798	792803	1.3	(0.8)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	1.2 (4)/good	
Big Piney Road											
Segment a	778798	777777	2.1	(1.3)	No data	All weather	Bituminous	8.2 (27)/excellent	Bituminous	2.4 (8)/good	Left turn lane at N. Dakota Avenue intersection.
Segment b	777775	777769	0.6	(0.4)	No data	All weather	Bituminous	8.2 (27)/excellent	Bituminous	2.4 (8)/good	
First Street											
Segment a	778805	796800	2.2	(1.4)	No data	All weather	Bituminous	8.5 (28)/good	Bituminous	2.7 (9)/good	Divided lanes at Missouri Avenue intersection.
Segment b (Route 10)	796800	830794	4.1	(2.5)	45	All weather	Bituminous	8.5 (28)/good	Gravel	2.7 (9)/fair	
Indiana Avenue											
Segment a	765827	757815	1.6	(1.0)	No data	All weather	Bituminous	13.4 (44)/excellent	No shoulder		Curb and Gutter; Parking.
Segment b	757815	763800	1.5	(0.9)	No data	All weather	Bituminous	9.1 (30)/excellent	Bituminous	2.4 (8)/good	
Segment c	763800	764776	2.6	(1.6)	No data	All weather	Bituminous	10.7 (35)/excellent	Bituminous	2.4 (8)/good	
Infantry Circle	776777	779777	0.4	(0.2)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	1.2 (4)/good	
Iowa Avenue											
Segment a	774797	763764	3.9	(2.4)	No data	All weather	Bituminous	12.5 (41)/excellent	No shoulder		Curb and Gutter; Left turn lanes at S. Dakota Avenue intersection.
Segment b (Route I)	763764	759761	0.5	(0.3)	No data	All weather	Bituminous	8.5 (28)/good	No shoulder		
Segment c (Route I)	759761	753649	12.6	(7.8)	No data	All weather	Bituminous	8.5 (28)/good	Gravel	2.4 (8)/fair	
Kansas Avenue											
Segment a	766782	774782	0.8	(0.5)	No data	All weather	Bituminous	13.4 (44)/excellent	No shoulder		Curb and Gutter; Parking.
Segment b	774782	784781	0.9	(0.6)	No data	All weather	Bituminous	7.9 (26)/good	Bituminous	1.2 (4)/good	
Minnesota Avenue											
Segment a	796800	774788	2.7	(1.7)	No data	All weather	Bituminous	10.1 (33)/good	Bituminous	2.4 (8)/good	Left turn lanes at Nebraska Avenue intersection.
Segment b	774788	766788	1.1	(0.7)	No data	All weather	Bituminous	13.4 (44)/excellent	No shoulder		Curb and Gutter; Parking.
Missouri Avenue											
Segment a	761832	778803	3.3	(2.0)	No data	All weather	Bituminous	2@7.3 (2@24)/excellent	Bituminous	2.4 (8)/good	Shoulder on right side only.
Segment b	778803	778798	0.6	(0.4)	No data	All weather	Bituminous	13.4 (44)/excellent	No shoulder		Left turn lanes at N. Dakota Avenue and Headquarters Avenue intersections.
Nebraska Avenue											
Segment a	786805	783797	0.9	(0.6)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	1.2 (4)/good	
Segment b	783797	784777	2.3	(1.4)	No data	All weather	Bituminous	9.1 (30)/excellent	Bituminous	3.0 (10)/excellent	Left turn lanes at S. Dakota Avenue and Replacement Avenue.
Segment c	784777	770769	1.6	(1.0)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	1.2 (4)/good	
North Dakota Avenue											
Segment a	774797	783797	1.7	(1.1)	No data	All weather	Bituminous	9.4 (31)/excellent	Bituminous	3.0 (10)/good	Left turn lanes at Iowa Avenue, Missouri Avenue and Nebraska Avenue intersections.
Segment b	769797	774797	0.7	(0.4)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	3.0 (10)/good	
North Training Road (Route KA)											
Segment a	794793	795793	0.1	(0.1)	No data	All weather	Bituminous	6.1 (20)/good	No data		
Segment b	795793	812793	2.0	(1.2)	No data	All weather, limited traffic	Improved dirt	6.1 (20)/fair	No shoulder		
Oklahoma Avenue	785800	789781	2.3	(1.4)	No data	All weather	Bituminous	6.7 (22)/good	Bituminous	1.8 (6)/good	Left turn lanes at Nebraska Avenue intersection.
Piney Hills Drive	789781	804780	1.7	(1.1)	No data	All weather	Bituminous	9.1 (30)/excellent	No shoulder		Curb and Gutter.
Plant Road	774816	785823	1.4	(0.9)	No data	All weather	Bituminous	7.3 (24)/excellent	No shoulder		
Pulaski Avenue	757814	774815	1.7	(1.1)	No data	All weather	Bituminous	9.1 (30)/excellent	Bituminous	1.2 (4)/good	Divided lanes at Missouri Avenue intersection.
Replacement Avenue											
Segment a	792803	783794	1.3	(0.8)	30	All weather	Bituminous	6.7 (22)/good	Bituminous	1.2 (4)/good	
Segment b	783794	774794	0.6	(0.4)	No data	All weather	Bituminous	12.2 (40)/excellent	Bituminous	2.4 (8)/good	
South Dakota Avenue											
Segment a	789781	784777	0.7	(0.4)	No data	All weather	Bituminous	7.3 (24)/good	Bituminous	1.2 (4)/good	
Segment b	784777	768777	1.4	(0.9)	No data	All weather	Bituminous	14.0 (46)/excellent	No shoulder		Curb and Gutter; Parking; Left turn lanes at Iowa Avenue and Nebraska Avenue intersections.
Segment c	768777	763776	0.5	(0.3)	No data	All weather	Bituminous	9.1 (30)/excellent	Bituminous	1.2 (4)/good	
Sturgis Drive	801777	803775	0.3	(0.2)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		Curb and Gutter; Parking.
Water Intake Road (Route 24)	797777	809767	1.6	(1.0)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

ROUTE NUMBER / NAME	ROUTE LOCATION (GRID REFERENCE)		LENGTH OF SEGMENT		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS
	FROM	TO	km	(mi)			CONSTRUCTION MATERIALS	WIDTH / CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH / CONDITION m (ft)	
Route A	762832	796833	4.4	(2.7)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No shoulder		
Route B	736824	764829	4.0	(2.5)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Route D											
Segment a	743674	739674	0.4	(0.2)	No data	Fair weather	Improved dirt	6.1 (20)/fair	No shoulder		
Segment b	739674	701697	7.3	(4.5)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Segment c	701697	689707	1.7	(1.1)	No data	Fair weather	Improved dirt	3.0 (10)/fair	No shoulder		
Segment d	689707	673710	1.6	(1.0)	No data	Fair weather	Improved dirt	4.9 (16)/good	No shoulder		
Segment e	673710	670712	0.3	(0.2)	No data	Fair weather	Improved dirt	3.0 (10)/fair	No shoulder		
Route E											
Segment a	742808	724799	3.4	(2.1)	No data	Fair weather	Improved dirt	6.1 (20)/good	No shoulder		
Segment b	724799	706807	1.8	(1.1)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No shoulder		
Segment c	706807	704808	0.3	(0.2)	No data	Fair weather	Unimproved dirt	3.0 (10)/poor	No shoulder		
Route F											
Segment a	743674	742662	1.3	(0.8)	No data	Fair weather	Improved dirt	6.1 (20)/fair	No shoulder		
Segment b	742662	741646	2.0	(1.2)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Route H											
Segment a	705748	731710	5.0	(3.1)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Segment b	691761	705748	2.0	(1.2)	No data	Fair weather	Gravel	6.7 (22)/good	No shoulder		
Segment c	696812	696811	0.1	(0.1)	No data	All weather	Bituminous	6.1 (20)/good	No shoulder		
Segment d	696831	696822	1.0	(0.6)	No data	All weather	Bituminous	6.1 (20)/good	No shoulder		
Route K											
Segment a	798799	804803	0.9	(0.6)	No data	All weather	Bituminous	7.3 (24)/good	No data		
Segment b	804803	821800	1.9	(1.2)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route N											
Segment a	813752	825747	1.3	(0.8)	No data	All weather	Bituminous	7.3 (24)/fair	No shoulder		
Segment b	825747	833748	0.8	(0.5)	No data	All weather	Bituminous	7.3 (24)/fair	Gravel	0.9 (3)/fair	
Segment c	833748	821737	2.1	(1.3)	No data	Fair weather	Improved dirt	3.7 (12)/poor	No shoulder		
Segment d	821737	798734	2.8	(1.7)	No data	Fair weather	Improved dirt	5.5 (18)/fair	No shoulder		
Route P											
Segment a	739722	747724	0.8	(0.5)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Segment b	723722	739722	1.6	(1.0)	No data	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Route Q	748718	779726	3.7	(2.3)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Route R											
Segment a	779743	779726	1.9	(1.2)	No data	Fair weather	Improved dirt	5.5 (18)/fair	No shoulder		
Segment b	779726	763664	9.5	(5.9)	(2) T 38 (1) T 44*	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Segment c	763664	756657	1.3	(0.8)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No shoulder		
Route S											
Segment a	747679	767677	2.1	(1.3)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Segment b	741679	747679	0.6	(0.4)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route T	705710	655672	7.2	(4.5)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Route U											
Segment a	735641	729643	0.6	(0.4)	No data	Fair weather	Improved dirt	4.3 (14)/poor	No shoulder		
Segment b	729643	700653	3.3	(2.1)	No data	Fair weather	Improved dirt	5.5 (18)/fair	No shoulder		
Segment c	700653	668620	5.5	(3.4)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		Part within impact area.
Route V	756752	756745	0.7	(0.4)	No data	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Route W											
Segment a	746737	709735	4.0	(2.5)	(2) 14 (1) 18	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Segment b	709735	689735	2.1	(1.3)	No data	All weather, limited traffic	Gravel	5.5 (18)/fair	No shoulder		
Segment c	689735	678706	4.1	(2.5)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Segment d	662685	657673	1.6	(1.0)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Route AB											
Segment a	781820	784830	1.2	(0.7)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Segment b	784830	795831	1.2	(0.7)	No data	Fair weather	Improved dirt	6.7 (22)/good	No shoulder		
Route DD	723672	699686	3.0	(1.9)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Route DU	713666	720648	2.5	(1.6)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Route ED											
Segment a	719760	710765	1.1	(0.7)	No data	Fair weather	Unimproved dirt	3.0 (10)/fair	No shoulder		
Segment b	710765	716803	4.8	(3.0)	No data	All weather, limited traffic	Improved dirt	4.3 (14)/fair	No shoulder		
Route EE	751800	738798	1.9	(1.2)	No data	Fair weather	Improved dirt	7.3 (24)/good	No shoulder		
Route EF	710762	712753	1.0	(0.6)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Route EH	716803	737812	2.7	(1.7)	No data	Fair weather	Improved dirt	3.0 (10)/poor	No shoulder		
Route NA	795752	787735	3.5	(2.2)	No data	Fair weather	Gravel	6.1 (20)/good	No shoulder		
Route PA	739722	736710	1.3	(0.8)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route RA	782694	745698	3.9	(2.4)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		
Route RB	752658	759656	0.7	(0.4)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Route SA	746698	747679	1.9	(1.2)	No data	Fair weather	Improved dirt	6.1 (20)/good	No shoulder		
Route TT	705710	689707	1.8	(1.1)	No data	Fair weather	Improved dirt	7.3 (24)/fair	No shoulder		
Route UA	689645	655656	4.0	(2.5)	60	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		Part within impact area.
Route UB	690666	656656	4.1	(2.5)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		Part within impact area.
Route UD	702676	689653	3.0	(1.9)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		Part within impact area.

*T = Tracked; (1) = one-way; (2) = two-way

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

Route Number / Name	Route Location (Grid Reference)		Length of Segment		Military Load Classification	Route Type	Surface		Shoulder		Remarks
	From	To	km	(mi)			Construction Materials	Width / Condition m (ft)	Construction Materials	Width / Condition m (ft)	
Route UU											
Segment a	689653	698621	4.2	(2.6)	No data	Fair weather	Improved dirt	4.3 (14)/fair	No shoulder		Within impact area.
Segment b	697669	689653	1.9	(1.2)	No data	Fair weather	Improved dirt	3.0 (10)/poor	No shoulder		Part within impact area.
Route WP											
Segment a	731735	731722	1.3	(0.8)	No data	All weather, limited traffic	Gravel	7.9 (26)/good	No shoulder		
Segment b	731722	732710	1.3	(0.8)	No data	All weather, limited traffic	Gravel	6.1 (20)/good	No shoulder		
Route 5											
Segment a	734794	740740	5.5	(3.4)	No data	All weather, limited traffic	Gravel	7.9 (26)/good	No shoulder		
Segment b	729810	734794	1.9	(1.2)	No data	All weather, limited traffic	Gravel	4.3 (14)/fair	No shoulder		
Segment c	737812	729810	1.8	(1.1)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route 8											
Segment a	763800	751800	1.3	(0.8)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Segment b	751800	737812	2.2	(1.4)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Segment c	737812	698828	5.6	(3.5)	No data	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Route 9	796833	795808	2.8	(1.7)	No data	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Route 15											
Segment a	777769	779745	2.5	(1.5)	No data	All weather	Bituminous	7.3 (24)/good	Gravel	0.6 (2)/poor	
Segment b	779745	792703	5.1	(3.2)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route 20	766782	705748	8.1	(5.0)	No data	All weather, limited traffic	Gravel	7.3-9.1 (24-30)/good	No shoulder		
Route 22											
Segment a	820777	837783	2.5	(1.6)	No data	Fair weather	Gravel	6.1 (20)/fair	No shoulder		
Segment b	803776	820777	2.0	(1.2)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Route 25	826789	815748	7.6	(4.7)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Route 26	810769	835770	3.3	(2.0)	Less than 8	All weather	Bituminous	7.3 (24)/good	No shoulder		
Route 28											
Segment a	756752	742755	2.0	(1.2)	No data	All weather	Bituminous	7.3 (24)/good	Gravel	1.8 (6)/poor	
Segment b	742755	716754	2.7	(1.7)	No data	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Route 30											
Segment a	779745	767745	1.3	(0.8)	No data	All weather	Bituminous	7.3 (24)/good	Gravel	0.5 (1.5)/poor	
Segment b	767745	748745	2.0	(1.2)	No data	All weather	Bituminous	7.3 (24)/good	Gravel	0.9 (3)/fair	
Segment c	748745	736747	1.1	(0.7)	No data	All weather	Concrete	7.3 (24)/fair	Gravel	0.9 (3)/fair	
Route 32	784774	808761	2.9	(1.8)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Route 36	777766	814750	4.6	(2.9)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route 37	710732	710711	1.6	(1.0)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route 38											
Segment a	747710	712711	3.6	(2.2)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Segment b	712711	705710	0.7	(0.4)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Route 46											
Segment a	755649	744646	1.0	(0.6)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Segment b	744646	735637	1.8	(1.1)	No data	All weather, limited traffic	Gravel	6.1 (20)/good	No shoulder		
State Highway TT											
Segment a	792677	792670	1.0	(0.6)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Segment b	792667	791665	0.1	(0.1)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Unnamed Road	731710	730700	1.2	(0.7)	No data	All weather	Bituminous	7.3 (24)/good	No shoulder		
Unnamed Road	732710	740692	2.1	(1.3)	No data	All weather, limited traffic	Gravel	6.1 (20)/fair	No shoulder		
Unnamed Road	796823	795800	2.7	(1.7)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No shoulder		
Unnamed Road	828792	838776	2.9	(1.8)	No data	Fair weather	Improved dirt	5.5 (18)/fair	No shoulder		
Unnamed Road											
Segment a	833763	837762	0.6	(0.4)	No data	Fair weather	Improved dirt	6.1 (20)/fair	No shoulder		
Segment b	837762	851768	2.2	(1.4)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Unnamed Road	745758	744746	1.3	(0.8)	No data	All weather, limited traffic	Gravel	8.5 (28)/good	No shoulder		
Unnamed Road	735756	740745	1.7	(1.1)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Unnamed Road	742755	740738	2.0	(1.2)	No data	All weather, limited traffic	Gravel	9.6 (32)/good	No shoulder		
Unnamed Road	727710	730700	1.0	(0.6)	No data	All weather, limited traffic	Improved dirt	7.3 (24)/good	No shoulder		
Unnamed Road											
Segment a	743690	733693	1.1	(0.7)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Segment b	733693	732689	0.5	(0.3)	No data	Fair weather	Improved dirt	3.0 (10)/fair	No shoulder		
Unnamed Road	752745	746738	1.0	(0.6)	No data	All weather, limited traffic	Gravel	7.3 (24)/good	No shoulder		
Unnamed Road	753649	755649	0.2	(0.1)	No data	Fair weather	Gravel	7.3 (24)/fair	No shoulder		
Unnamed Road	741641	743640	0.3	(0.2)	No data	All weather, limited traffic	Gravel	6.1 (20)/good	No shoulder		
Unnamed Road	726629	726621	0.8	(0.5)	No data	All weather, limited traffic	Gravel	6.1 (20)/good	No shoulder		
Unnamed Road	668620	654620	1.3	(0.8)	No data	Fair weather	Gravel	4.9 (16)/fair	No shoulder		
Unnamed Road	815748	809733	2.0	(1.2)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No shoulder		
Unnamed Road	817749	824747	1.1	(0.7)	No data	Fair weather	Gravel	5.5 (18)/fair	No shoulder		
Unnamed Road	833748	836742	0.7	(0.4)	No data	Fair weather	Gravel	4.3 (14)/fair	No shoulder		
Unnamed Road	740774	741768	0.7	(0.4)	No data	Fair weather	Gravel	6.1 (20)/fair	No shoulder		
Unnamed Road	733738	731735	0.5	(0.3)	No data	Fair weather	Gravel	6.1 (20)/fair	No shoulder		
Unnamed improved dirt roads (other)			17.9	(11.1)	No data	Fair weather	3-4.9 varies (10-16)	No shoulders			
Unnamed unimproved dirt roads (other)			55.1	(34.2)	No data	Fair weather	3-3.7 varies (10-12)	No shoulders			

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)



Route W, looking west from Route I, is an all weather gravel road typical of loose-surface roads on the reservation. Note irregular, undefined shoulders and concrete ford (Ford 41) in background.



Concrete ford (Ford 22), located on Route 15, an all weather gravel road, at grid reference 787736. Concrete fords, eleven in all, are located throughout the reservation where erosion hazards are severe.

ROAD BRIDGES

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD* CLASSIFICATION	DIMENSIONS	CLEARANCE	TYPE / CONSTRUCTION MATERIALS	CONDITION	REMARKS
1/FLW 1	Route UA	678645	Caby Hollow	60	15.0m (49.2 ft) Total Length 15.0m (49.2 ft) Length longest span 4.3m (14.1 ft) Total width 4.3m (14.1 ft) Roadway width	Unlimited vertical 4.3m (14.1 ft) horizontal	Concrete box culvert / concrete deck.	No data	1 lane.
2/FLW 1A	Route 46	744647	Musgrave Hollow	None	17.4m (51.1 ft) Total length 4.6m (15.1 ft) Length longest span 4.9m (16.1 ft) Total width 4.9m (16.1 ft) Roadway width	Unlimited vertical 4.9m (16.1 ft) horizontal	Timber trestle / concrete abutments; wood deck.	Poor	1 lane. Bridge replacement recommended. Decking needs replacement. Repair required before load classification can be made.
3/FLW 5	Route 5	740738	Intermittent Stream	(2) 14 W (1) 18 W	32.0m (105.0 ft) Total length 32.0m (105.0 ft) Length longest span 6.8m (22.3 ft) Total width 6.8m (22.3 ft) Roadway width	Unlimited vertical 6.8m (22.3 ft) horizontal	Concrete box culvert / concrete deck.	Good	2 lanes.
4/FLW 9	Route W	719735	Intermittent Stream	16	18.3m (60.0 ft) Total length 4.7m (15.4 ft) Length longest span 4.6m (15.0 ft) Total width 4.3m (14.2 ft) Roadway width	Unlimited vertical 4.3m (14.2 ft) horizontal	Timber trestle / timber abutments; wood deck.	Fair	1 lane. Requires maintenance. Decking needs replacement.
5/FLW 12	Replacement Avenue	784794	Dry Creek	30	9.2m (30.0 ft) Total length 4.6m (15.0 ft) Length longest span 10.1m (33.0 ft) Total width 9.1m (30.0 ft) Roadway width	Unlimited vertical 9.1m (30.0 ft) horizontal	Reinforced concrete slab / concrete abutments; concrete deck.	Good	2 lanes.
6/FLW 14	Army Avenue	784800	Dry Creek	Unlimited Class	7.0m (23.0 ft) Total length 3.1m (10.0 ft) Length longest span 13.1m (43.0 ft) Total width 9.1m (30.0 ft) Roadway width	Unlimited vertical 9.1m (30.0 ft) horizontal	Reinforced concrete box culvert / concrete deck.	Good	2 lanes. Load classification greater than 150 for both Tracked and Wheeled vehicles, one and two way.
7/FLW 15	Route R	786708	McCourtney Hollow	W T (2) 57 38 (1) 67 44	12.0m (39.3 ft) Total length 10.1m (33.0 ft) Length longest span 7.9m (26.0 ft) Total width 7.3m (24.0 ft) Roadway width	Unlimited vertical 7.3m (24.0 ft) horizontal	Reinforced concrete beam / concrete abutments; concrete deck.	Good	2 lanes.
8/FLW 17	First Street	790805	Dry Creek	60	11.6m (38.0 ft) Total length 3.2m (10.6 ft) Length longest span 21.3m (70.0 ft) Total width 14.2m (46.6 ft) Roadway width	Unlimited vertical 15.0m (49.2 ft) horizontal	Reinforced concrete slab / concrete abutments; concrete deck.	Good	2 lanes. Construction joints need re-sealing.
9/FLW 20	Route 10	830794	Big Piney River	45	117.0m (384.0 ft) Total length 21.3m (70.0 ft) Length longest span 8.8m (29.0 ft) Total width 8.2m (27.0 ft) Roadway width	Unlimited vertical 8.2m (27.0 ft) horizontal	Steel I Beam / concrete abutments; concrete deck.	Good	2 lanes.
10/FLW 21	Route 26	811768	Big Piney River	< 8	67.1m (222.0 ft) Total length 16.8m (55.0 ft) Length longest span 5.0m (16.5 ft) Total width 3.8 m (12.5 ft) Roadway width	Unlimited vertical 3.8m (12.5 ft) horizontal	Steel I Beam / steel trusses; concrete abutments; wood deck.	Fair	1 lane. If decking were upgraded to 100% lamination, military load class could be upgraded to 16.
11/FLW 22	Route 26	834764	Big Piney River	15	146.3m (480.0 ft) Total length 39.6m (130.0 ft) Length longest span 4.9m (16.0 ft) Total width 4.0m (13.0 ft) Roadway width	Unlimited vertical 4.0m (13.0 ft)	Aluminum truss and beam / concrete abutments; aluminum grid deck.	Good	1 lane. Design referred to as French Bailey Bridge.
12	Plant Road	777817	Intermittent Stream	No data	7.0m (23.0 ft) Total length 7.3m (24.0 ft) Roadway width	Unlimited vertical 7.3m (24.0 ft) horizontal	Three corrugated metal pipes.	Fair	2 lanes. Each pipe 152.4cm (60 in). Regular maintenance required to remove debris.
13	Route 20	761782	Pond Hollow	No data	10.1m (33.0 ft) Total length 10.7m (35.0 ft) Total width 7.3m (24.0 ft) Roadway width	Unlimited vertical 7.3m (24.0 ft) horizontal	Three reinforced concrete pipes / stone abutments.	Fair	2 lanes. Each pipe 91.4cm (36 in). Regular maintenance required to remove debris.
14	Route P	744723	Intermittent Stream	No data	7.0m (23.0 ft) Total length 8.5m (28.0 ft) Total width 6.4m (21.0 ft) Roadway width	Unlimited vertical 6.4m (21.0 ft) horizontal	Timber trestle / concrete abutments; wood deck.	Fair	2 lanes.
15/FLW 23	Unnamed Road	845772	Stone Mill Spring	4	16.5m (54.0 ft) Total length 7.6m (25.0 ft) Length longest span 4.3m (14.0 ft) Roadway width	Unlimited vertical 4.3m (14.0 ft) horizontal	Steel I Beam / concrete abutments; wood deck.	Good	1 lane.

*All classifications are for one-way wheeled traffic unless noted:

W = Wheeled; T = Tracked; (1) = one-way; (2) = two-way.

J. LINES OF COMMUNICATION (Continued)

2. RAILROADS

IDENTIFICATION* NUMBER	SEGMENT OF TRACK (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT m (ft)		OWNERSHIP OF LINE AND CONDITION OF TRACK	TRACK AND BED CHARACTERISTICS	CROSSOVERS (GRID REFERENCE)	SIDINGS AND WYES (GRID REFERENCE)	VOLUME OF TRAFFIC	REMARKS
1	Bundy Jct. (km 0.0)	790790 (km 31.7)	31,700	(104,000)	U.S. Government owned; good condition, meeting Federal Railway Admini- stration track safety standards for Class 2 or better. Burlington North- ern railroad located at Bundy Jct., 31.7km (19.7 mi) from installation.	Single track, standard gage (1.44m or 4 ft 8.5 in); maximum grade of 2° 31' (4.4%); maximum curvature of 8 degrees; weight of rails 54.6 kg/m (110 lb/yd); ballast material: crushed limestone.		Wye at Bundy Jct. Wye on reservation and sidings are listed separately as seg- ments.	Averages less than 10 railcars per month.	40 kph (25 mph) maximum speed limit; tonnage capacity 653.1 gross metric tons (720 gross tons); 44 total track switches (entire system) including 18 main line switches, 26 back track switches with 43 49.9 kg (110 lb) switch No. 10 turnout and one 38.6 kg (85 lb) switch No. 10 turnout. No storage or loading capacity; total of 33 track crossings, including 13 public, 12 private, and eight street crossings.
Segment a†	(km 0.8)	(km 1.0)	243.8	(800)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Kelley Siding. Serves as passing track.
Segment b†	(km 11.1)	(km 12.3)	1106.1	(3629)		Weight of rails 42.2 kg/m (85 lb/yd)	No crossovers			Passing track No. 2, Hunt Siding; 51 railcar storage capacity; used for loaded storage.
Segment c†	(km 20.0)	(km 20.4)	506.0	(1660)		Weight of rails 42.2 kg/m (85 lb/yd)	No crossovers			Passing track No. 3, Wern Siding; 30 railcar storage capacity; serves as passing track.
Segment d†	(km 26.1)	(km 26.5)	409.7	(1344)		Weight of rails 42.2 kg/m (85 lb/yd)	No crossovers			Passing track No. 4, Lee Siding; 25 railcar storage capacity; serves as passing track.
Segment e	795809	793807	335.3	(1100)		Weight of rails 49.6 kg/m (100 lb/yd)	No crossovers			West leg of wye; used in conjunction with segments f and g for switching and turning cars.
Segment f	793807	795803	640.1	(2100)		Weight of rails 49.6 kg/m (100 lb/yd)	No crossovers			East leg of wye; used in conjunction with segments e and g for switching and turning cars.
Segment g	793807	791807	144.8	(475)		Weight of rails 49.6 kg/m (100 lb/yd)	No crossovers			Tail of wye; L.P. gas unloading facilities at west end of track (grid reference 791807), capacity five 114,000 L (30,000 gal) tank cars; accessible for loading boxcars and gondolas; one derail at entrance to tail of wye; side ramp.
Segment h	794807	793807	73.2	(240)		Weight of rails 42.2 kg/m (85 lb/yd)	No crossovers			Hunger Spur; two railcar storage capacity; could be used for boxcar loading; one railcar loading capacity; side ramp.
Segment i	796802	796804	216.4	(710)		Weight of rails 42.2 kg/m (85 lb/yd)	No crossovers			Gas track; L.P. gas onloading facility at north end (grid reference 796804).
Segment j	796801	796804	374.9	(1230)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Directorate of Facilities Engineering (DFAE) Track No. 1; 21 railcar storage capacity; services engineer equipment yard; concrete side ramp.
Segment k	796801	796803	256.0	(840)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			DFAE Track No. 2; 15 railcar storage capac- ity; services engineer equipment yard; three railcar loading capacity.
Segment l	796800	793793	803.1	(2635)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Passenger Track No. 1; 24 railcar storage capacity; temporary loaded storage; 24 railcar loading capacity.
Segment m	796800	793793	734.6	(2410)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Passenger Track No. 2; 26 railcar storage capacity; temporary loaded storage; 29 railcar loading capacity; one derail at north end (grid reference 796800).
Segment n	796800	793793	826.6	(2712)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Passenger Track No. 3; 26 railcar storage capacity; empty storage; 31 railcar loading capacity.
Segment o	796800	793793	615.7	(2020)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Passenger Track No. 4; 24 railcar storage capacity; empty storage; one derail at north end (grid reference 796800).
Segment p	796796	796797	115.8	(380)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Gas spur; gasoline unloading facility, capac- ity three tank cars; one derail at entrance (grid reference 796796).
Segment q	795798	794794	283.5	(930)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Coal trestle recently dismantled; three rail- car loading capacity at side dock; concrete side ramp.
Segment r	792792	795799	794.9	(2608)		Weight of rails 49.6 kg/m (100 lb/yd)	794796, 794797			Warehouse Track No. 1; 18 railcar storage capacity; outloading of wheeled or light tracked vehicles; 13 railcar loading capac- ity without blocking Second St; earth and concrete end ramp; warehouse buildings 2303-07, 2319-26, volume 32,638.4m³ (1,152,487 ft³).
Segment s	793794	795799	714.1	(2343)		Weight of rails 49.6 kg/m (100 lb/yd)	794796, 794797			Warehouse Track No. 2; 26 railcar storage capacity; outloading of wheeled or light tracked vehicles; 13 railcar loading capac- ity without blocking Second St; earth and concrete end ramp; warehouse buildings 2310-11, 2313-14, 2318, volume 15,345.4m³ (541,858 ft³).
Segment t	792792	794800	799.8	(2624)		Weight of rails 49.6 kg/m (100 lb/yd)	793796, 793797			Warehouse Track No. 3; 43 railcar storage capacity; 13 railcar loading capacity without blocking Second St; earth and concrete end ramp; warehouse buildings 2332, 2334-39, volume 26,006.3m³ (918,302 ft³).
Segment u	792792	794800	753.5	(2472)		Weight of rails 49.6 kg/m (100 lb/yd)	793796, 793797			Warehouse Track No. 4; 35 railcar storage capacity; 13 railcar loading capacity without blocking Second St; earth and concrete end ramp.
Segment v	792792	794800	743.7	(2440)		Weight of rails 49.6 kg/m (100 lb/yd)	793796, 793797			Warehouse Track No. 5; 40 railcar storage capacity; warehouse buildings 2340-45, volume 22,291.1m³ (787,116 ft³).
Segment w	793798	794800	132.6	(435)		Weight of rails 49.6 kg/m (100 lb/yd)	No crossovers			Laundry Track; inactive.
Segment x	791792	790791	112.5	(369)		Weight of rails 44.6 kg/m (90 lb/yd)	No crossovers			Gun Spur; six railcar storage capacity; outloading of tracked vehicles; seven rail- car loading capacity; concrete end ramp; some lighting.

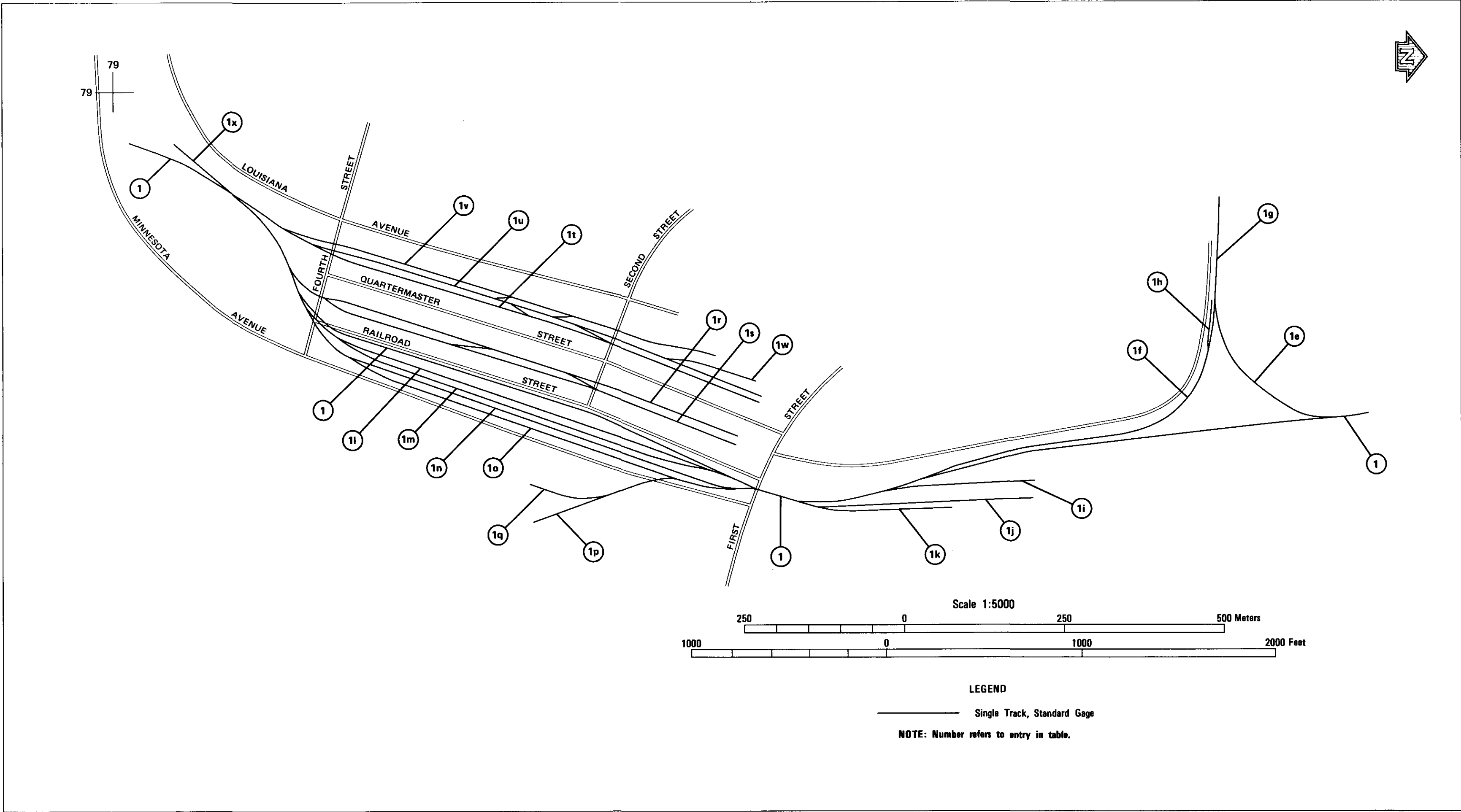
*For segment configuration, see Railroad Sidings Enlargement on page 40.

† Located outside of Fort Leonard Wood boundary.

J. LINES OF COMMUNICATION (Continued)

2. RAILROADS (Continued)

RAILROAD SIDINGS ENLARGEMENT



RAILROAD BRIDGES

IDENTIFICATION NUMBER	LOCATION* DISTANCE MARKER		FEATURE CROSSED	NUMBER OF TRACKS	ROADWAY WIDTH m (ft)	CLEARANCE		DECK MATERIAL	OVERALL LENGTH		TYPE OF STRUCTURE	REMARKS
	km	(mi)				HORIZONTAL	VERTICAL		m	(ft)		
1 (BR AB 0.2)	0.4	(0.2)		One	No data	Unlimited	Unlimited	Wood	17.7	(58)	Open deck timber pile trestle.	Located on east leg of wye at Bundy Jct. Permissible load limit 114,000 kg (251,000 lbs) except cars shorter than 10.7m (35 ft) limited to 95,000 kg (210,000 lbs).
2 (BR AB 0.2 A)	0.4	(0.2)		One	No data	Unlimited	Unlimited	Wood	17.7	(58)	Open deck timber pile trestle.	Located on west leg of wye at Bundy Jct. Permissible load limit 114,000 kg (251,000 lbs) except cars shorter than 10.7m (35 ft) limited to 95,000 kg (210,000 lbs)
3 (BR AB 0.3)	0.5	(0.3)	Little Piney River	One	2.7 (9)	No data	6.7m (22 ft)	Wood	271.6	(891)	One 49.8m (163.5 ft) through truss steel span; 52 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Permissible load limit 114,000 kg (251,000 lbs) except cars shorter than 10.7m (35 ft) limited to 95,000 kg (210,000 lbs).
4 (BR AB 0.6)	1.1	(0.7)		One	No data	Unlimited	Unlimited	Wood	21.6	(71)	Six panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
5 (BR AB 1.9)	3.1	(1.9)		One	No data	Unlimited	Unlimited	Wood	44.5	(146)	11 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
6 (BR AB 3.0)	5.0	(3.1)		One	No data	Unlimited	Unlimited	Wood	32.9	(108)	Eight panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
7 (BR AB 4.3)	7.1	(4.4)	County road	One	No data	Unlimited	Unlimited	Wood	29.0	(95)	Seven panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
8 (BR AB 10.7)	17.2	(10.7)	Woodland Hollow Creek	One	No data	Unlimited	Unlimited	Wood	106.7	(350)	25 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
9 (BR AB 12.1)	19.5	(12.1)	Big Piney River	One	No data	No data	6.7m (22 ft)	Wood	536.8	(1761)	Two 46.5m (152.5 ft) through truss steel span; 76 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord on 6° curve; 33 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
10 (BR AB 14.1)	22.7	(14.1)	Dry Creek	One	No data	Unlimited	Unlimited	Wood	41.5	(136)	Ten panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord on 7° curve.	Same as 3 above.
11 (BR AB 14.5)	23.3	(14.5)	Dry Creek	One	No data	Unlimited	Unlimited	Wood	49.7	(163)	13 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.
12 (BR AB 14.7)	23.7	(14.7)	Dry Creek	One	No data	Unlimited	Unlimited	Wood	70.4	(231)	18 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord on 0-8° spiral curve.	Same as 3 above.
13 (BR AB 15.0)	24.1	(15.0)	Dry Creek	One	No data	Unlimited	Unlimited	Wood	42.1	(138)	Ten panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord on 6° curve.	Same as 3 above.
14 (BR AB 15.6)	25.1	(15.6)	Dry Creek	One	No data	Unlimited	Unlimited	Wood	51.5	(169)	11 panel open deck timber pile trestle, four ply, 4.3m (14 ft) chord.	Same as 3 above.

*Bridges U.S. Army property outside of Fort Leonard Wood boundary. Distances are from Bundy Jct.

J. LINES OF COMMUNICATION (Continued)

3. AIRFIELDS

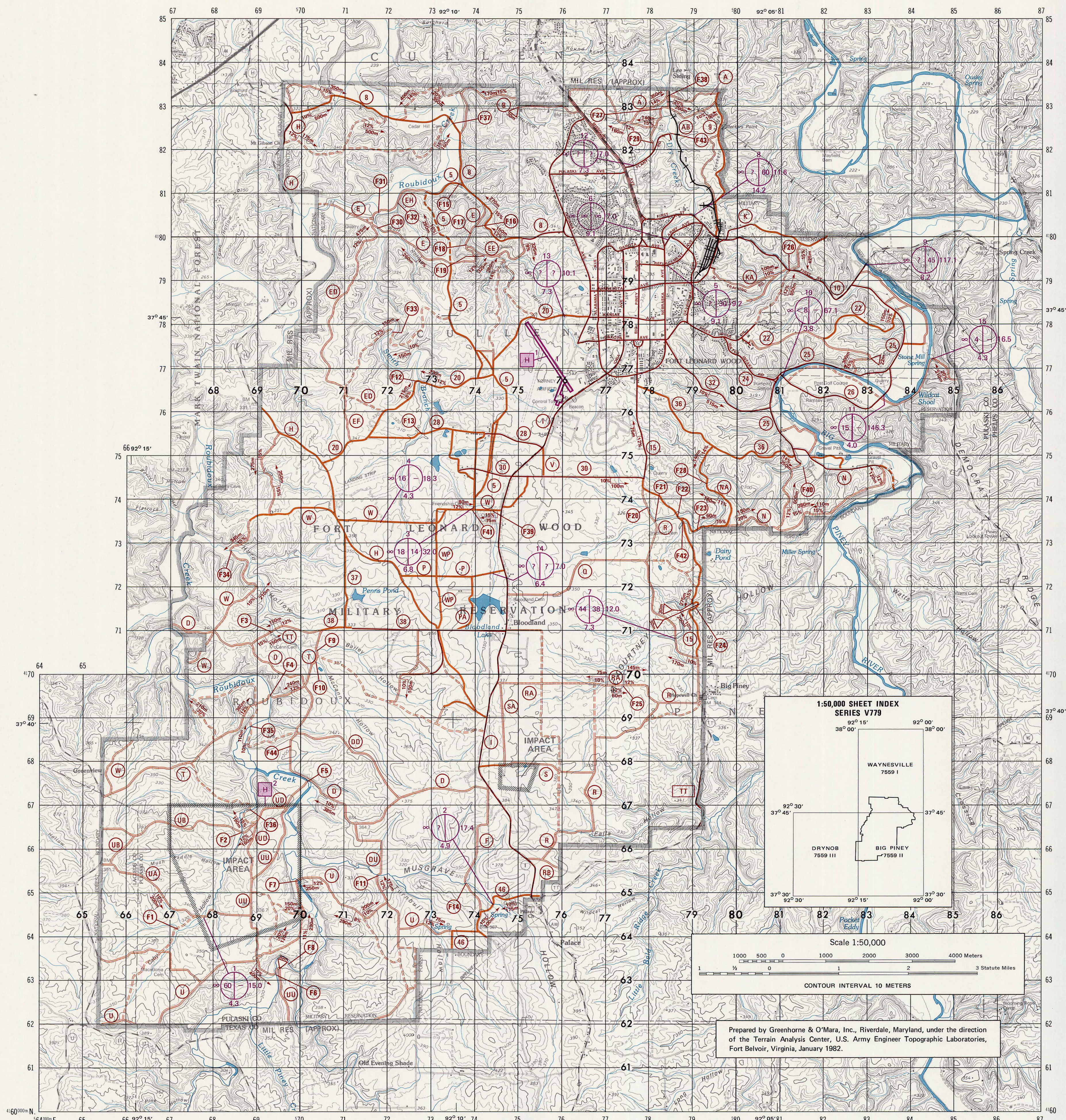
MAP NUMBER AND NAME; LOCATION; CLASSIFICATION; AND TYPE	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
1. Forney Army Airfield; 37° 44'N, 92° 08' W; (grid reference 761767); Army; Airfield; (jointly used by Frontier Airlines).	349m (1145.8 ft); operational.	<u>North-South 14-32</u> 1843 x 46m (6046 x 150 ft); azimuth 140° - 320°; maximum weight bearing capacity S100, T105, TT230*; asphalt surface, good condition.	<u>Taxiway</u> One; 18m (60 ft); maximum weight bearing capacities are the same as runway; asphaltic concrete surface, good condition. <u>Parking Apron and Hardstand</u> 18,478m ² (198,900 ft ²) approxi- mate total area; maximum weight bearing capacity same as runway; asphaltic concrete, good condition.	<u>Hangars and Maintenance Facilities</u> Two aircraft maintenance and storage hangars, building numbers 5007 and 5017; approximate total area, one 892m ² (9600 ft ²), one 274m ² (2952 ft ²); both concrete, steel, steel roof; one permanent, one temporary. <u>Administration and Terminal Buildings</u> Three airfield operations buildings, numbers 5003, 5004, and 5015; one 125m ² (1350 ft ²), concrete, wood, shingle roof, temporary; one 106m ² (1149 ft ²), concrete steel, steel roof, permanent; one 354m ² (3812 ft ²), temporary. Building number 5004, also contains weather station. Frontier Airlines terminal building number 5002, 214m ² (2304 ft ²), concrete, wood, shingle roof, temporary. <u>Other Buildings</u> Airfield fire and rescue squad station, building number 5001, 365m ² (3924 ft ²), permanent; radar build- ing, number 5008, 21m ² (231 ft ²), temporary; receiver building, number 5010, 40m ² (434 ft ²), semi-perma- nent; aviation club, 106m ² (1144 ft ²), concrete, wood, shingle roof, temporary. <u>Other Navigation Aids</u> Wind indicator; lighted wind T.	<u>Tanks</u> JP-4; two tanks (above ground), total capacity 9084 L (2400 gal); three tanks (underground), total capacity 113,550 L (30,000 gal), fuel pumps at each tank. Aircraft POL storage area (grid reference 742752), tanks (underground), total capacity 113,550 L (30,000 gal).	<u>Control Tower</u> 27m (90 ft) high, 175m ² (1882 ft ²), concrete, steel, pre-fab siding, permanent. <u>Navigational and Landing Aids</u> Weather station; VHF omni- directional range (VOR); Tactical Air Navigation (TACAN) UHF pulse type omni range and distance measuring equipment (DME); combination VOR and TACAN (VORTAC); Instrument Landing System (ILS); non-directional radio beacon (NDB); precision approach radar (PAR); approach surveillance radar (ASR), opera- tional 1400-2200Z, except holidays. <u>Lights</u> Solid white rotating beacon; medi- um intensity approach lighting system with sequenced flashing lights; runway end identifier lights; visual approach slope indicator system (VASI); taxiway has edge surface lights.	Caution: deer may be on runway; no civilian maintenance or aircraft fuel available. Frontier currently has four scheduled flights daily Monday through Saturday, and three flights on Sunday with flight connections to St. Louis, MO, Dallas, TX, Harrison, Fayetteville, and Fort Smith, AR. Flight Service information (FSS), (VICHY) call 1-800-392-0820. Taxi service available; no rental car.

*Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, and TT. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.
S = Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F100).
T = Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).
TT = Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135).

For further information, see DOD Flight Information Publication (enroute IFR-Supplement United States).

4. HELICOPTER LANDING ZONES

MAP NUMBER AND/OR NAME	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION m (ft)	SURFACE MATERIAL	RESTRAINTS	REMARKS
1. (Forney Army Airfield)	757773	Not applicable	140° - 320°	353.0 (1158)	Asphaltic concrete	No restraints	Control tower; arriving and departing helicopters use main runway under tower control.
2. Cannon Range 50	692670	149m ² (1602 ft ²)	No data	340.0 (1115)	Asphalt	Not used during artillery or air-to-ground firing.	Helicopters require Range Control clearance.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

ROADS

- Hard surface divided, 4 or more lanes
- Hard surface, 2 or 3 lanes
- Loose surface, 2 or more lanes
- Loose surface, 1 lane
- Improved dirt
- Unimproved dirt

TT State route designator

A Reservation route designator

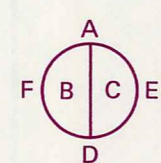
500m 20% Grade (percentage, direction, and length; given only if >7 percent)

30m Radius of curvature (vertex of triangle points to curve; Figure indicates radius if <30m)

BRIDGE DATA

(Measurements in meters)

- A Bridge number (See Table)
- B One-way military load classification
- C Two-way military load classification
- D Roadway width
- E Length
- F Overhead Clearance
- ∞ Unlimited
- ? Unknown
- Single lane, no two-way classification



F44 Ford (see Section B, SURFACE DRAINAGE, for data)

RAILROADS

- Single track, standard gage
- Multiple track, standard gage
- (See Railroad Sidings Enlargement in text)

AIRFIELDS

Airfield

HELICOPTER LANDING ZONES

Landing zone

NOTE: Number refers to entry in table.

K. URBAN AREA (CANTONMENT AREA)

TROOP BILLETs

TYPE	NUMBER OF BUILDINGS	CAPACITY	CONDITION *	REMARKS
Trainee				Trainee billets are allotted 6.5m ² (72 ft ²) per person or a maximum of 60 persons per bay. All billets are co-ed.
Permanent	40	11,432 MN [†]	Good	
Semipermanent	78	1782	9 Good; 69 Fair	
Temporary	200	8882	Poor	Barracks built in the early 1940's are not presently used for troop billets. Long-range plans (beyond FY 1982) include upgrading of some substandard barracks. Plans for construction are based upon installation realignment contingencies. Plans exist to transform a few of these buildings into a World War II museum.
Total	318	22,096		
Permanent Party				Permanent party live in the newly built (1978) barracks near South Dakota Avenue and Oklahoma Avenue. Permanent party are allowed 8.1m ² (90 ft ²) per person.
Permanent	28	2370	Good	
Total	28	2370		
*Based on personal communication with Housing Division of the Directorate of Facilities Engineering personnel. Barracks built prior to 1960=Poor; barracks built from 1960 to 1970=Fair; and, barracks built after 1970=Good condition.				
[†] MN = Persons, designed capacity.				

QUARTERS

TYPE	NUMBER OF BUILDINGS	CAPACITY	CURRENT LOAD *	YEAR OF CONSTRUCTION	CONDITION [†]	REMARKS
Bachelor Officer Quarters (BOQ)						All BOQ are permanent structures. Building 4100, built in 1965, is classified as substandard. May be made adequate by the installation of central air conditioning. Window air conditioners are being used as approved by Headquarters, Department of the Army.
Building number 4100	1	40 MN [†]	38 MN [†]	1965	Fair	
Building number 4100,4111, 4112	3	75	73	1973	Good	Permanent structures show an average occupancy rate of 80 percent capacity annually. Summer capacity approaches 100 percent (97 percent in June 1981).
Building number 4113, 4114, 4115	3	51	50	1973	Good	
Total	7	166	161		6 Good; 1 Fair	
Bachelor Enlisted Quarters (BEQ)						All BEQ are classified as substandard. May be made adequate by the installation of central air conditioning.
Building Number 4101	1	40	40	1966	Fair	
Building Number 4102	1	48	46	1966	Fair	
Building Number 4103	1	44	42	1966	Fair	
Total	3	132	128		3 Fair	
Guest Houses						All guest housing is classified temporary and substandard. May be made adequate with some remodeling. Fifty-three rooms have been upgraded over the past two years.
Total	16	132 RM§	128	1941-1966	Fair	No construction of quarters is planned for FY 1982. Demolition of buildings 1751 and 1753, temporary BOQ which are no longer in use, is planned for FY 1982.
*Current Load based on figures obtained 19 June 1981.						
[†] Based on personal communication with Housing Division of the Directorate of Facilities Engineering personnel. Barracks built prior to 1960=Poor; barracks built from 1960 to 1970=Fair; and barracks built after 1970=Good condition.						
[‡] MN = persons, design capacity.						
§ RM = rooms.						

FAMILY HOUSING

TYPE	NUMBER OF BUILDINGS	NUMBER OF FAMILY UNITS	CURRENT LOAD	YEAR OF CONSTRUCTION	CONDITION *	REMARKS
General	2	2	2	1957	Good	Located on MacKenzie Drive. Most are wood frame construction with some brick and stone veneer. All General's and some field grade officers' housing consist of Ranch and Cape Cod.
Colonel	10	10	10	1957	Good	Located along MacKenzie Drive.
Lieutenant Colonel/ Major	20 30 24	20 30 24	20 30 24	1957 1959 1963	Good Good Good	Located on MacKenzie Drive, Piney Hills Drive, Delafield Drive, and Gridley Loop. Most are wooden duplexes. Two houses usually reserved for Lieutenant Colonels and Majors are presently occupied by Noncommissioned Officers due to a housing shortage.
Company Grade Officer/ Warrant Officer	48 64	48 64	48 64	1959 1962	Good Good	Located on Delafield Drive, Sibert Lane, Williams Street, Wheeler Street, Humphrey's Street, and Swift Street. Most are wooden duplexes. Due to a housing shortage, 145 houses are currently occupied by Noncommissioned Officers.
Noncommissioned Officers (NCO)	83 423 125 227 67	83 1074 398 482 328	83 1023 398 482 328	1959 1960 1961 1962 1963	Good Good Good Good Good	Located primarily in the northwestern and southeastern sections of the cantonment area. Most are single-family and 2-8 duplex units, containing two to four bedrooms. A total of 147 duplex houses, originally used for officer housing, have been reassigned, due to NCO housing shortage. All are wooden construction.
Totals	1123	2563	2512			Housing on the reservation is considered adequate based on the present mission. No changes are planned through FY 1982. Most units were built with Capehart Funds. Occupancy rate for family housing is 98 percent and the only shortage is for families requiring five-bedrooms.
*Based on assessment by the Chief, Housing Division, Directorate of Facilities Engineering.						

K. URBAN AREA (CANTONMENT AREA)(Continued)

SCHOOLS AND MEDICAL FACILITIES

TYPE	CAPACITY	CURRENT LOAD*	REMARKS
SCHOOLS			
Pence Child Care Center	300	223	The child care center, which provides both pre-school and day care services, is in a former elementary school. Training and Doctrine Command (TRADOC) WEE CARE funds provided \$100,000 for 1980 renovations.
Elementary			
Partridge	400	319	There are six dependent schools in the Fort Leonard Wood cantonment, and three off-post schools attended by base dependents. All schools are owned and operated by Waynesville R-VI school system which is under the authority of the Department of Education.
Pershing	400	396	
Pick	500	444	
Thayer	400	342	
Williams	300	247	
Middle			
Wood	800	696	Off-post schools attended by base dependents include East Elementary, Waynesville Middle School, and Waynesville High School.
Higher Education			
Truman Education Center	2000	1598	Degrees up to the Ph.D. level are offered by several local colleges and universities, including University of Missouri at Rolla, Drury College, Webster College, and Central Texas College. Both day and evening classes are available.
MEDICAL FACILITIES			
Hospital			The hospital and medical area are in the north-central portion of the cantonment, bounded by Missouri Avenue on the west, Third Street on the south, Illinois Avenue on the east, and Headquarters Avenue on the north (grid reference 780800). The hospital has 54 medical doctors and five dentists.
General Leonard Wood Army Community Hospital (building number 310)	179 beds 23 ICU 9 surgery 14 regular treatment		General Leonard Wood Army Community Hospital was completed in 1965. A helipad is planned for the area east of the hospital to provide emergency medical airlift transportation.
Clinic Facilities	4 units		Three male and one female designated clinic facilities exist. A centralized troop clinic is planned containing 1858m ² (20,000 ft ²), directly east to the 800-area barracks.
Dental Clinics (5)			Dental clinics are permanent facilities. Fort Leonard Wood is in a remote area lacking adequate medical facilities and is authorized to provide dental services to military personnel, retired military personnel, and their dependents. Currently there are 24 dentists associated with the clinics. Three more dental operation units are planned.
Building number 500	28 operating units		Building number 3051 is the dental laboratory.
Building number 606	28		
Building number 1608	28		
Building number 2365	3		
Building number 3051	0		
Total	87		

*Based on 1980-1981 school year enrollment; except for Truman Education Center which is based on average one semester enrollment.

RECREATION FACILITIES

TYPE	CAPACITY	REMARKS
OUTDOOR FACILITIES		
1 Golf Course		The Fort Leonard Wood 18-hole golf course on FLW Route 26 east of the cantonment area has a clubhouse and locker rooms. It is operated by the Activities Division of the Directorate of Personnel and Community Activities. The course is in good condition, and is adequate for future requirements. It is used by both military and civilian personnel.
1 Golf Driving Range		
5 Multiple Courts		Multiple courts are located throughout the reservation and are used for basketball, tennis, and volleyball.
4 Outdoor Swimming Pools		One pool is associated with the Officer's Club and restricted to Officers, and their families and guests. The remaining three pools serve the entire reservation. One is currently not in use due to maintenance problems.
2 Parks		Two main parks, Collier and Indiana, and a number of small parks are located throughout the reservation; all are heavily used. Collier Park has covered shelters, barbeque facilities, picnic tables, and latrines. Indiana Park is used mostly by dependents.
1 Football Field		One official football field, Gerlock Field, serves intercommand, intramural, and junior high school events. It is equipped with lights.
1 Soccer Field		Kennedy Field is adjacent to Wood Junior High. It is used for intercommand, intramural, junior high school, and Army Dependent Youth Activities events.
9 Softball Fields		Softball fields are numerous. The main field is Hilltop, next to Collier Park. These fields serve as soccer fields in the off-season.
2 Baseball Fields		
32 Volleyball Courts		
2 Skeet Fields	1-8 Firing Point Skeet Range 1-4 Firing Point Trap Range	Located at grid reference 804804 (see Section L, Non-Urban Culture Features, for data).
25 Tennis Courts		Tennis courts are concrete topped with resilient surfacing material.
1 Riding Stable and Track		Located on Buckeye Avenue, the riding stable, barn and paddock includes facilities to house a number of horses.
21 General-Purpose Playgrounds		General-purpose playgrounds are located throughout the family housing areas on the reservation.
5 Dirt Tracks		Five major dirt tracks are used for Physical Readiness Training. Gerlock Field dirt track is used for sporting events.
INDOOR FACILITIES		
12 Gymnasiums	3-1897m ² (20,425 ft ²) 1-1559m ² (16,784 ft ²) 8-340m ² (3663 ft ²)	Each brigade and Specker Barracks has a gymnasium. The reservation has a central gymnasium known as Nutter Field House.
4 Theaters	1000 seats 998 seats 970 seats 380 seats	Four theaters with stages serve Fort Leonard Wood. Only three are active; one is used for storage. The Reception Station uses one; the other two are for general use. The Piney Hill Players, a theatrical club, uses the one playhouse on the reservation.
2 Bowling Centers	2502m ² (26,936 ft ²) 3173m ² (34,160 ft ²)	Built in 1968 and 1972, these two bowling centers are in excellent condition.
2 Libraries	302m ² (3256 ft ²) 487m ² (5247 ft ²)	Both are branch libraries; the main library is still in a planning stage.
6 Recreation Centers	2407m ² (25,908 ft ²) 209m ² (2250 ft ²) 1375m ² (14,800 ft ²) 3662m ² (39,424 ft ²) 821m ² (8840 ft ²) 106m ² (1144 ft ²)	
Physical Fitness Center		
Recreation Building		
Skill Development Center		
General Education Development Center		
Auto Self-Help Garage		
Aviation Club		
OUTDOOR OFF-POST FACILITY		
Army Recreation Travel Camp	146 hectares (360 acres)	Fort Leonard Wood maintains an Army Recreation Travel Camp on the Lake of the Ozarks which provides lodging, camping, boating, fishing, hiking, swimming, and spelunking facilities for military personnel. A post exchange for small purchases and first aid station are available.

K. URBAN AREA (CANTONMENT AREA) (Continued)

TELECOMMUNICATIONS

TYPE	CAPACITY AND CURRENT LOAD	REMARKS
Official Telephone	One 7200-line dial telephone exchange servicing 6645 subscribers 10,540 instruments	The communications-electronics systems at Fort Leonard Wood are owned, operated, and maintained by the government through the tenant United States Army Communications Command Agency on the reservation. The agency supports host installation emergency communication operations, provides administrative control for all communications service authorized for the states of Missouri and Illinois, and operates a post military high frequency radio system. Secure voice (AUTOSEVOCOM) capability. Assumption of unofficial telephone services (Class "B" subscribers) by the local telephone company in March of 1982 will free approximately 3700 numbers for official use if required. Existing quantities of toll (Long Distance) and city (St. Robert/Waynesville, MO) trunks will be reduced simultaneous with the March 1982 loss of the 3700 unofficial subscribers. New trunk groups will be established to interface with a new, telephone company installed, digital switch that will support the March 1982 conversion.
	One 6-position administrative switchboard (processes non-dialed calls; provides operator assistance)	
	One 600-line electronic private automatic branch exchange (EPABX) serving hospital facility 555 subscribers, 555 instruments	
	One 200-line electronic private automatic branch exchange (EPABX) serving dental facilities 200 subscribers, 200 instruments	
	28 AUTOVON network trunks	
	8 FTS two-way trucks	
Unofficial Telephone	50 Outgoing toll trunks 32 Incoming toll trunks 20 Outgoing city trunks 29 Incoming city trunks 38 Two-way city trunks	United Telephone Company of Missouri owns and operates all commercial toll service to and from Fort Leonard Wood. This is provided via a digital microwave installation on the reservation between Headquarters Road and Missouri Avenue, which transfers the information to the Rolla toll center. There the facilities interface with South-western Bell's long distance facilities. United Telephone services 180 coin telephones, 135 residential-type tele-phones, and 48 coinless telephones at a telephone center on the reservation. As of March 1982, United Telephone will provide service for all residential housing areas and leased commercial facilities on the reservation, totalling 3500 customers. This will be provided through a new north digital switching system in which customer calling features will be made available.
	3700 subscribers	

ELECTRICITY

SUBSTATIONS	TRANSFORMERS	CAPACITY	LOAD	REMARKS
Primary Substations				The Sho-Me Power Corporation in Marshfield, Missouri supplies electric service to the reservation. Highest elec-trical demands historically occur during July and August, due to the heavy use of air conditioners. Spring and fall are periods of minimal demand. The three primary substations are interconnected with a 69 kV transmission loop which encircles the installation core area. Each building has its own transformer. Each substation is interconnected with the other in case of emergency. All 69 kV lines, equipment, main secondary switching, and metering are owned by the Sho-Me Power Corporation. The main reservation electric distribution system is in fair to good condition. Numerous modifications and repairs are being made as required to maintain the system in good condition.
Number 1	69 kV	15,000 kVA	Peak demand August 1981: 27,000 kW; Annual consumption FY 1980: 118.964 x 10 ⁶ kWh	
Number 2	69 kV	15,000 kVA		
Number 3	69 kVA	15,000 kVA		
Secondary-side Substations	7200 to 12,470 V			

FUEL OIL AND L.P. GAS

TYPE	STORAGE CAPACITY	CURRENT LOAD (average annual demand)*	REMARKS
FUEL OIL			Fort Leonard Wood does not have natural gas available. Fuel oil and liquid propane gas are furnished under an annual contract with regional suppliers to the six central plants on the reservation. The heating sources consist of hot water boilers. The six central plants serve the 168 permanent buildings of the reservation core area. Twenty-one buildings contain independent heating systems. Of family housing facilities totaling 2862 residential living units, 1500 use LPG and 1362 use fuel oil. All heating plants are capable of supplying adequate heat for the facilities they serve. Three plants have excess capacity and can serve future loads proposed for the regimental areas. Studies are under way to consider use of other fuel sources, such as coal and electric heating. The reservation has the capability to convert its heating plants from Number 6 fuel oil to Number 2 fuel oil in an emergency. The capability to convert the Reservation Laundry from Number 2 fuel oil to liquid propane gas exists if the situation warrants.
No. 1	757,000 L (200,000 gal)	70,117 L (18,525 gal)	
No. 2	2,978,000 L (786,790 gal)	12,476,957 L (3,296,422 gal)	
No. 6	2,448,243 L (646,828 gal)	14,718,173 L (3,888,553 gal)	
LPG 1	1,737,315 L (459,000 gal)	11,876,959 L (3,137,902 gal)	

*Based on FY 1980 total. The months of maximum use are January and February.

WATER SUPPLY

TYPE	CAPACITY	CURRENT LOAD*	REMARKS
SUPPLY			
Big Piney River	1340 x 10 ⁶ Lpd average flow [†] (354 x 10 ⁶ gpd average flow)	13.6 x 10 ⁶ Lpd (3.60 x 10 ⁶ gpd)	The Big Piney River is currently the primary source of water for the Fort Leonard Wood water system. Ground-water taken from a single active well in the vicinity of the Lieber Heights family housing area is used to supplement the surface supply during periods of peak demand. Stream flow in the Big Piney is adequate to supply the existing and future water requirements of the reservation. Water quality is quite good, requiring only minimal treatment for potable water supply. There are two wells within the cantonment area, one active. There is potential for further groundwater development at Fort Leonard Wood. Properly cased rock wells extending to mean sea level and spaced 457m (1500 ft) apart can be expected to yield an average of about 1136 Lpm (300 gpm) per well.
Well Fields (2)		658 Lpm (150 gpm)	
TREATMENT			
Treatment Plant	22.7 x 10 ⁶ Lpd (6.0 x 10 ⁶ gpd)	13.6 x 10 ⁶ Lpd (3.6 x 10 ⁶ gpd)	Water is brought into the cantonment area to the treatment plant through two parallel 41 cm (16 in) supply lines which originate from the pumping station on the west bank of the Big Piney River approximately a mile and a half west of the cantonment area. The pumping capacity of the station is estimated to be 33.3 x 10 ⁶ Lpd (8.8 x 10 ⁶ gpd). The existing treatment plant provides chemical coagulation, sedimentation, filtration, fluoridation, and disinfection of raw water obtained from the river. The chlorination facility, west of Lieber Heights family housing area, is used to disinfect groundwater supplies.
Chlorination Plant	3785 Lpd (1000 gpd)	3785 Lpd (1000 gpd)	

*Based on April 1981 figures.
[†]Lpd = liters per day
gpd= gallons per day
Lpm= liters per minute
gpm = gallons per minute

K. URBAN AREA (CANTONMENT AREA) (Continued)

WATER SUPPLY (Continued)

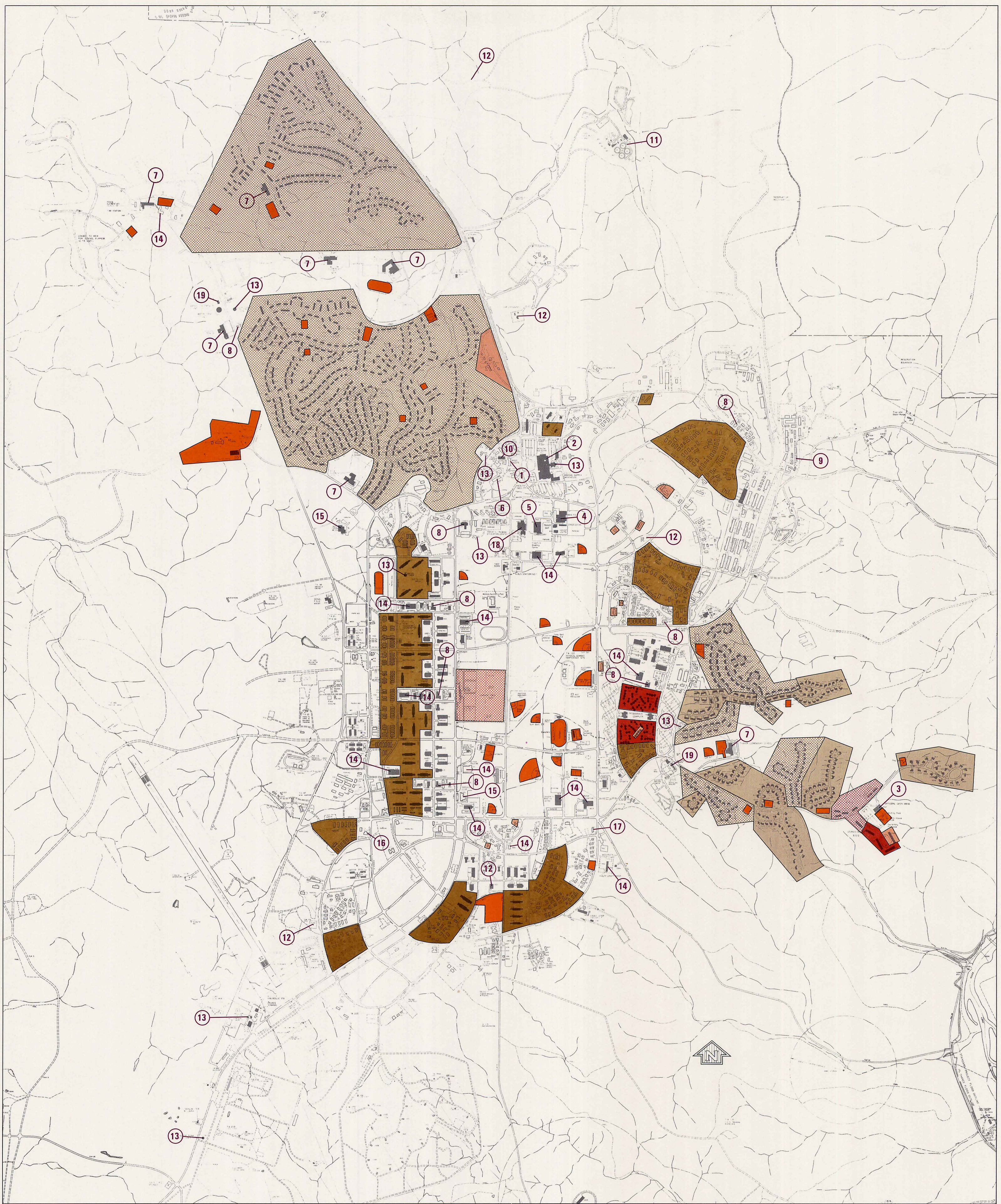
TYPE	CAPACITY	CURRENT LOAD*	REMARKS
STORAGE RESERVOIRS			
Elevated Tanks (Total)	5.7 x 10 ⁶ L (1.5 x 10 ⁶ gal)	95 percent capacity	Three elevated tanks are within the cantonment area.
Tank # 1	1.9 x 10 ⁶ L (0.5 x 10 ⁶ gal)		Tank #1 elevation is 383m (1256 ft) and is approximately 60m (200 ft) east of Indiana Avenue and 137m (500 ft) northeast of Pershing Elementary School (grid reference 759811).
Tank # 2	1.9 x 10 ⁶ L (0.5 x 10 ⁶ gal)		Tank #2 elevation is 389m (1275 ft) and is approximately 122m (400 ft) south of Fourth Street and 61m (200 ft) east of Buckeye Avenue (grid reference 711793).
Tank # 3	1.9 x 10 ⁶ L (0.5 x 10 ⁶ gal)		Tank #3 elevation is 383m (1256 ft) and is approximately 46m (150 ft) east of Route I at southwest corner of training area 210m (hand tools) (grid reference 757755).
Clear Well	5.7 x 10 ⁶ L (1.5 x 10 ⁶ gal)	95 percent capacity	Located at coagulation - filtration plant.
Ground Storage	8.52 x 10 ⁶ L (2.5 x 10 ⁶ gal)	95 percent capacity	Located at Lieber Heights plant and supplied from the Lieber Heights well. The main distribution system during periods of non-peak water demand. The total length of transmission and distribution water lines for Fort Leonard Wood is approximately 82 km (51 mi) for 20cm (8.0 in) and larger mains. Topography of the cantonment area is such that the distribution system is maintained under one pressure district at the present time. The existing distribution system can adequately supply normal demands under present conditions.

*Based on April 1981 figures.

SEWERAGE

PLANT	CAPACITY	AVERAGE DAILY FLOW	REMARKS
Sewage Treatment Plant	26.5 x 10 ⁶ Lpd* (7.0 x 10 ⁶ gpd) design capacity	9.5 x 10 ⁶ Lpd (2.5 x 10 ⁶ gpd)	The Fort Leonard Wood Sewage treatment plant is a trickling filter plant with tertiary treatment, and connected to a system serving the 2037 hectares (5000 acres) cantonment area. Recent improvements have nearly doubled the previous treatment capacity.
Pumping stations (7)	(5) 109 x 10 ⁶ Lpd (2.9 x 10 ⁶ gpd) (2) 1.5 x 10 ⁶ Lpd (0.4 x 10 ⁶ gpd)		Sewage flow per capita per day equals 435L (115 gal) which is based on a 22,624 reservation population for FY 1981. All sewage treatment facilities are permanent and more than sufficient to handle the current load. The sewage treatment plant, in the northeast portion of the cantonment area, provides complete treatment. It has two treatment lagoons, six treatment plant buildings, ten primary treatment plants, eight secondary treatment plants, seven pumping stations, and one collection building (see Section L, Non-Urban Culture Features for facilities description).

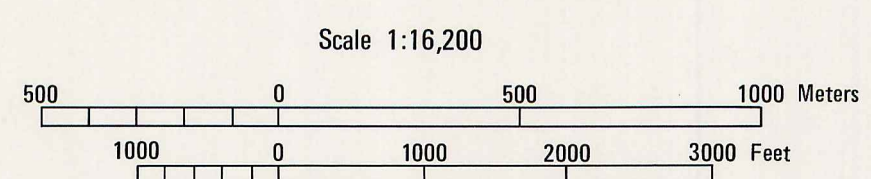
*Lpd = liters per day; gpd = gallons per day.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

URBAN AREA (CANTONMENT AREA)

AREA FEATURES			
	Family Housing, Officers		Bachelor Enlisted Quarters
	Family Housing, NCO's		Guest Houses
	Barracks, Troop Quarters		Parade Ground
	Bachelor Officer's Quarters		Outdoor Recreation Facilities



POINT FEATURES	
	Post Headquarters
	Post Hospital
	Officers' Open Mess
	Post Exchange
	Commissary
	Post Office
	Dependent School
	Chapel
	Directorate of Facilities Engineering
	Telephone Exchange
	Sewage Treatment Plant
	Electric Power Substation
	Flight Obstruction
	Indoor Recreation Facility
	NCO Club
	Service Men's Club (EM Club)
	Post Museum
	Education Center
	Water Treatment Plant

Prepared by Greenhorne & O'Mara, Inc., Riverdale, Maryland, under the direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, January 1982.

L. NON-URBAN CULTURE FEATURES

On the Fort Leonard Wood reservation, there are at least 184 manmade features outside the cantonment area which could either positively or negatively affect military training and operations. Most of the features depicted on the accompanying map and described below, consist of various types of buildings, cemeteries, and towers; many are associated with various ranges and training areas on the reservation. In addition, scattered throughout the post are temporary, multi-purpose, 21m² (225 ft²), moveable wooden buildings. These buildings are not included on the post real property inventory records. Therefore, in most cases, these buildings were not considered as a point feature on the map or included in ranges or training areas described below.

For reasons of protection, various significant archeological sites on the reservation have not been plotted; for specific information, contact the Directorate of Facilities Engineering, Environmental and Planning Branch.

Fort Leonard Wood maintains a 360-acre Army Recreation Travel Camp at the Lake of the Ozarks (see Section K, Urban Areas (Cantonment Area) for a description of services available). Included in the description below are the types and kinds of facilities maintained by the Army.

MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	765831	Buildings (contractor storage area): Five single-wide mobile home trailers, temporary; three storage buildings, concrete, metal, metal roof, semipermanent; four storage buildings, concrete, plywood, rolled roof, temporary; multi-use building, wood, metal, metal roof, temporary.	30	762753	Petroleum Disposal Area.
2	774826	Power substation: 15,000 kVA capacity.	31	764749	Sanitary Landfill and Solid Water Disposal (inactive).
3	784822	Sewage Treatment Plants: Two sewage treatment plant lagoons, one 7.49 x 10 ⁵ Lpd (1.98 x 10 ⁵ gpd); six sewage treatment plant buildings, one 153m ² (1644 ft ²), concrete, steel, 264.95 x 10 ⁵ Lpd (70 x 10 ⁵ gpd), one 15.14 x 10 ⁵ Lpd (4.0 x 10 ⁵ gpd), with standby generator 400 kW, one 239m ² (2576 ft ²), one 970m ² (10,443 ft ²), one 62m ² (675 ft ²), one 147m ² (1660 ft ²), four concrete, concrete block/brick, concrete roof deck with four-ply built-up roof; eight secondary sewage treatment plants, one .28 x 10 ⁵ Lpd (.08 x 10 ⁵ gpd), one 828.92 x 10 ⁵ Lpd (219 x 10 ⁵ gpd), one 8.34 x 10 ⁵ Lpd (2.20 x 10 ⁵ gpd), one 549.6 x 10 ⁵ Lpd (145.2 x 10 ⁵ gpd), four 137.4 x 10 ⁵ Lpd (36.3 x 10 ⁵ gpd); ten primary sewage treatment plants, one 41 x 10 ⁵ Lpd (11 x 10 ⁵ gpd), one 829 x 10 ⁵ Lpd (219 x 10 ⁵ gpd); four 20.8 x 10 ⁵ Lpd (5.5 x 10 ⁵ gpd), four 49.05 x 10 ⁵ Lpd (28.80 x 10 ⁵ gpd); sewage pumping station building, 71m ² (760 ft ²), seven sewage pumping stations, five 109 x 10 ⁵ Lpd (28.80 x 10 ⁵ gpd), two 15.5 x 10 ⁵ Lpd (4.1 x 10 ⁵ gpd); sewage collection building, 1243m ² (13,384 ft ²), concrete, masonry, built-up roof, all sewage treatment plant facilities are permanent.	32	760753	Solid Waste Disposal Area.
4	804804	Recreation Area (trap and skeet range): Applied instruction building, 237m ² (2552 ft ²), concrete, steel, steel roof, semipermanent.	33	768747	Target Detection Area (inactive), TA215: Observation tower; one set of bleachers, temporary.
5	799795	NBC Test DPTS site (gas chamber), TA76: Two gas chambers, one 93m ² (966 ft ²), one 80m ² (870 ft ²), both concrete, wood, steel roof, temporary.	34	758752	Panel Bridge Training, TA211: Five general instruction buildings, one 111m ² (1200 ft ²), one 234m ² (2520 ft ²), three 33m ² (360 ft ²), all concrete, wood, steel roof, temporary.
6	834785	Pontoon Storage Area: Fence, width 91m (300 ft), length 122m (400 ft), height 1.5m (5.0 ft), barbed wire.	35	774746	Firing Range (inactive): Observation tower.
7	843778	Floating Bridge Training Area, TA250: General instruction building, 111m ² (1200 ft ²), concrete, wood, wood roof, temporary; applied instruction building, 212m ² (2280 ft ²), concrete, wood, steel roof, temporary; ten multi-use buildings ₍₁₎ .	36	769744	Range 1 (Train Fire Record): General administration building ₍₁₎ ; range house, 28m ² (305 ft ²) concrete, concrete block, built-up roof, permanent; observation tower without range finder, 40m ² (429 ft ²), concrete, steel, built-up roof, permanent; multi-use building, 19m ² (200 ft ²), concrete, metal, metal roof, permanent; one set of bleachers, temporary.
8	841774	Abandoned Airstrip (Big Piney Airstrip): Approximate elevation, 235m (772 ft) mean sea level, runway length 396m (1300 ft), width 30m (100 ft), azimuth 80°-260°, grass and scrub.	37	779732	Cemetery, Bradford.
9	845773	Recreation Area (Stone Mill Spring): Two bridges, one steel cable suspension, wood deck 1.4m (4.5 ft) width, 97m (319.7 ft) length, one concrete deck, 4.0m (14 ft) width, 16m (54 ft) length; two latrines, concrete, wood, rolled roof, semipermanent; five picnic shelters, concrete, wood, no walls, steel roof, temporary; six picnic tables, concrete block.	38	782715	Ruins: Concrete foundation.
10	841770	Recreation Area (Happy Hollow Recreational Area): Four picnic tables, wood; four picnic shelters, concrete, wood, no walls, asphalt shingle roof; two latrines, concrete, wood, asphalt shingle roof; four picnic tables, concrete block.	39	764745	Range 2 (25 Meter): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; latrine ₍₅₎ ; multi-use building ₍₆₎ ; one set of bleachers, permanent.
11	839775	Bivouac Area (inactive): 132 abandoned tent floors, concrete, permanent.	40	758746	Range 3 (Field Fire): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; latrine ₍₅₎ ; multi-use building ₍₆₎ ; one set of bleachers, permanent.
12	814771	Building (Girl Scout lodge): Lodge, 56m ² (600 ft ²), concrete, wood, wood roof, temporary.	41	755745	Range 4 (Field Fire): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₈₎ ; latrine ₍₅₎ ; multi-use building ₍₇₎ ; one set of bleachers, permanent.
13	821767	Recreation Area (golf course): Golf course clubhouse, 161m ² (1728 ft ²), concrete, wood, built-up roof, permanent; waiting shelter, 119m ² (1276 ft ²), concrete, wood/brick, metal roof, permanent; 18 hole regulation golf course.	42	751741	Range 5 (25 Meter): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; latrine ₍₉₎ ; multi-use building ₍₇₎ ; two sets of bleachers, both temporary.
14	824764	Buildings: Facility engineering maintenance shop, 173m ² (1872 ft ²), concrete, steel, permanent; storage shed, 111m ² (1200 ft ²), concrete, wood, steel roof, permanent.	43	748738	Range 6 (25 Meter): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; two latrines ₍₅₎ ; multi-use building ₍₆₎ ; one set of bleachers, gravel, steel, steel roof, permanent.
15	816763	Cemetery, Ramsey.	44	747735	Range 7 (Field Fire): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; multi-use building ₍₆₎ ; one set of bleachers ₍₁₀₎ .
16	836747	Range 62 (Wheeled Vehicle Recovery Course): General instruction building 558m ² (6333 ft ²), concrete, metal, metal roof, semipermanent.	45	747730	Range 8 (Field Fire): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; latrine ₍₉₎ ; multi-use building ₍₄₎ ; one set of bleachers ₍₁₀₎ .
17	833745	Ruins: Two concrete foundations.	46	749723	Range 9 (Night Fire): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; general instruction buildings ₍₁₁₎ ; multi-use building ₍₆₎ ; bleachers.
18	832743	Buildings: Two buildings, concrete, wood, rolled roof, semipermanent.	47	749720	Range 10 (25 Meter): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; latrine ₍₉₎ ; multi-use building ₍₇₎ ; two sets of bleachers, both temporary.
19	814751	Quarry Machine Operators Course, TA 256: Chlorinator building, 34m ² (368 ft ²), concrete, wood, asphalt roof, temporary; two general instruction buildings, both 168m ² (1813 ft ²), concrete, wood, rolled roof, semipermanent; five multi-use buildings ₍₁₎ .	48	749718	Cemetery, Bloodland.
20	808767	Pumping Station: Water pumping house, 236m ² (2546 ft ²), all concrete, permanent; utility shed, concrete, metal, metal roof, permanent; chain-link fence.	49	749716	Range 11 (25 Meter): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; multi-use building ₍₇₎ ; one set of bleachers, temporary.
21	801760	Ammunition Storage Area: Ready Magazine, 39m ² (420 ft ²), concrete, wood, semipermanent, safety distance 366m (1200 ft).	50	749712	Range 12 (Field Fire): General administration building ₍₂₎ ; range house ₍₃₎ ; observation tower ₍₄₎ ; multi-use building ₍₇₎ ; two sets of bleachers, temporary.
22	811755	Water Supply Course, TA259: Fire-fighting tower, concrete, wood, asphalt roof, semipermanent; two general storehouses, one 113m ² (1215 ft ²), one 193m ² (2069 ft ²), both concrete, wood, temporary; four applied instruction buildings, one 146m ² (1576 ft ²), one 217m ² (2335 ft ²), two 334m ² (3600 ft ²), all concrete, wood, steel roof, semipermanent.	51	748711	Range 13 (Field Fire): Range house ₍₃₎ ; observation tower ₍₄₎ ; latrine ₍₉₎ ; multi-use building ₍₇₎ ; three target sheds, temporary; bleachers, gravel, metal, metal roof, temporary.
23	810750	Tanks: Three water tanks.	52	748709	Range 14 (inactive).
24	787748	Ammunition Storage Area: General administration building, 120m ² (1300 ft ²), concrete, concrete block, metal deck roof, permanent; ammunition hut, 223m ² (2400 ft ²), concrete, concrete block, metal deck, permanent; small arms storage (pyrotechnics magazine), 1115m ² (12,000 ft ²), concrete, steel roof covered with earth, permanent; eight general purpose magazines 211m ² (2268 ft ²), concrete, steel roof covered with earth, permanent; small weapons magazine, 63m ² (676 ft ²), concrete, concrete block, metal roof, permanent, safety distance 549m (1800 ft).	53	748708	Range 15 (inactive) (Quick Fire): Observation tower, semipermanent; vault, concrete, permanent.
25	761757	Field Engineering Training, TA206: Applied instruction building, 147m ² (1580 ft ²), concrete, wood, asphalt rolled roof, temporary.	54	749703	Range 16 (Known Distance): Building, concrete, wood, rolled roof, semipermanent; latrine, all wood, rolled roof, semipermanent; three multi-use buildings ₍₁₎ .
26	763756	Building: Applied instruction building, 1178m ² (12,667 ft ²), concrete, steel, semipermanent.	55	747701	Range 17 (Pistol/Shotgun): Range house ₍₇₎ .
27	760755	Hand Tool Training Course, TA210: General instruction building, 240m ² (2580 ft ²), concrete, concrete block, wood, steel roof, temporary; general storehouse, 77m ² (830 ft ²), concrete, steel roof, semipermanent; generator shed, temporary; one set of bleachers, temporary.	56	747706	Range 18 (Machine Gun): General instruction building ₍₁₁₎ ; applied instruction building, 93m ² (1000 ft ²), concrete, metal, metal roof, semipermanent; range house ₍₁₂₎ ; observation tower ₍₁₃₎ ; multi-use building ₍₆₎ .
28	765754	Sewage Pumping Station: Building, 28m ² (301 ft ²), concrete, wood, steel roof, 142 x 10 ⁵ Lpd (3.74 x 10 ⁵ gpd) capacity, permanent.	57	754691	Ruin: Brick chimney.
29	772756	Motor Transport Operators Course, TA190 (Formerly Ammunition Storage Area): Ordnance administration building, 66m ² (710 ft ²), concrete, wood, wood roof, temporary; 24 ready magazine buildings, seven 19m ² (200 ft ²), sixteen 74m ² (800 ft ²), one 38m ² (407 ft ²); all are concrete, steel, steel roof, semipermanent; fence, chain-link, barbed wire.	58	747677	Range 19 (U.S. Weapons): Two general instruction buildings ₍₁₁₎ ; range house ₍₁₂₎ ; observation tower without range finder, concrete, metal, asphalt shingle roof, permanent; latrine, 126m ² (1360 ft ²), wood, metal/fiberglass, metal roof, semipermanent; multi-use building ₍₆₎ ; one set of bleachers, temporary.
			59	752670	Range 20 (Train Fire Record): General administration building ₍₂₎ ; range house ₍₁₂₎ ; observation tower ₍₁₃₎ ; multi-use building ₍₆₎ ; two sets of bleachers, both semipermanent.
			60	754666	Range 21 (Train Fire Record): General administration building ₍₂₎ ; range house ₍₁₂₎ ; observation tower ₍₄₎ ; multi-use building ₍₆₎ ; two sets of bleachers, one temporary, one permanent.
			61	747650	Building: Bunker, concrete, wood, permanent.
			62	739676	Range 24 (Demolitions): Two sets of bleachers, both gravel, wood, semipermanent.
			63	733692	Range 27 (Squad Live Fire Assault): Range house ₍₁₄₎ ; observation tower ₍₈₎ ; multi-use building ₍₁₅₎ ; equipment shelter ₍₁₆₎ ; bleachers, temporary; flagpole, metal.
			64	731699	Range 28 (U.S. Weapon Demonstration): Range training building ₍₁₅₎ ; range house, 28m ² (30 ft ²), concrete, wood, permanent; observation tower ₍₈₎ ; latrine ₍₅₎ ; equipment shelter ₍₁₆₎ ; bleachers ₍₁₀₎ ; flagpole; two monuments (jet aircraft).
			65	744708	Range 25 (Grenade Launcher): Observation tower ₍₈₎ ; mess shelter, temporary; latrine; storage building.
			66	746710	Bloodland Range Control: Range Control building, 223m ² (2400 ft ²), concrete, concrete block, built-up roof, permanent; maintenance building, concrete, metal, metal roof, semipermanent; storage shed, concrete, metal, metal roof, semipermanent; communication tower, metal.

L. NON-URBAN CULTURE FEATURES (Continued)

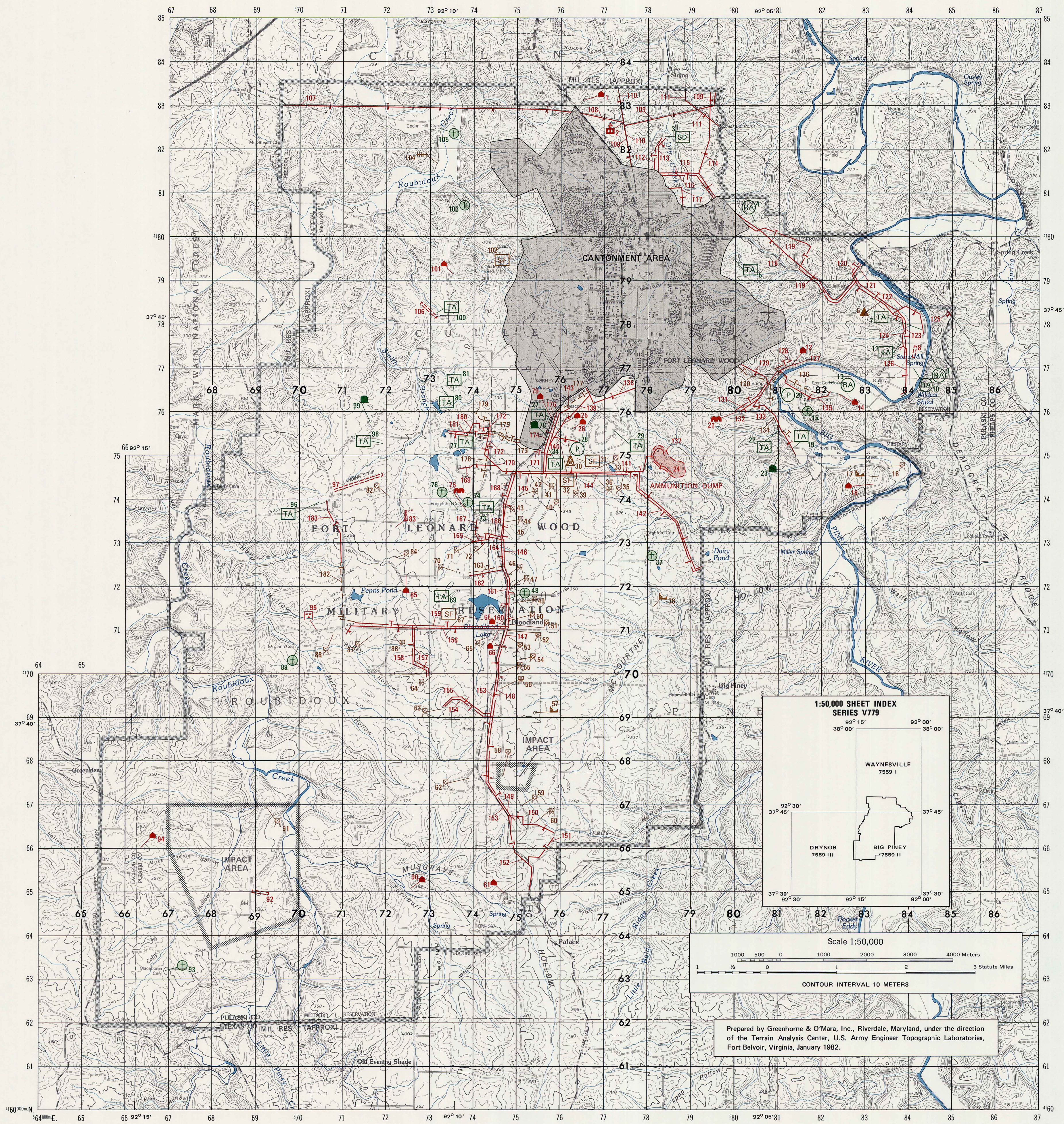
MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	GRID REFERENCE	DESCRIPTION
67	743712	Sanitary landfill.	110	773834 to 776816	Powerline ₍₁₉₎ ; Gospel Ridge Circuit.
68	747711	Building (old range control building): General administration building 63m ² (672 ft ²), concrete, wood, wood roof, temporary.	111	788833 to 796825	Powerline ₍₂₀₎ .
69	736719	Drivers Training Course (heavy vehicle), TA236.	112	783823 to 781815	Communication cable: Six pairs of 22 gage plastic insulated cable (PIC), wooden pole-mounted.
70	736724	Squad Tactics, TA235: Two observation towers ₍₈₎ ; two sets of bleachers, one permanent, one temporary.	113	783823 to 781815	Powerline ₍₂₁₎ .
71	741731	Range 31 (Hand Grenade): Range house ₍₁₂₎ ; latrine ₍₅₎ ; multi-use building ₍₆₎ ; storage shed, 19m ² (200 ft ²), concrete, metal, metal roof, permanent; training course structure, concrete, metal, permanent; two sets of bleachers ₍₁₀₎ ; 12 throwing stations.	114	794833 to 792815	Powerline ₍₂₂₎ .
72	743730	Target Detection Area (inactive): Observation tower; bleachers, temporary.	115	783815 to 795809	Powerline ₍₂₂₎ .
73	746740	Target Detection Area, TA200A: Building, bleachers.	116	783815 to 795809	Communication cable ₍₂₃₎ .
74	741737	Cemetery, Clark.	117	788807 to 785811	Powerline, post internal distribution: Three-wire # 4/0 all copper, wood pole-mounted.
75	738737	Ammunition Dumps.	118	825787 to 800806	Powerline ₍₂₂₎ .
76	736738	Cemetery, Friendship.	119	828790 to 801804	Communication cable ₍₂₃₎ .
77	741755	Construction Machinery Operators Courses, TA244: General Construction Machine Operators Course (grid reference 735756): Two general instruction buildings, one ₍₁₇₎ , one ₍₁₁₎ . Shovel Crane Course (grid reference 739759): General instruction building ₍₁₇₎ . Concrete Paving School (grid reference 738755): Four general instruction buildings ₍₁₇₎ . Scoop Loaders Operators Course (grid reference 738745): General instruction building ₍₁₇₎ . Machine Operators Training Center (grid reference 741755): 13 applied instruction buildings, one 171m ² (1836 ft ²), one 613m ² (6600 ft ²), one 1208m ² (13,000 ft ²), one 1152m ² (12,400 ft ²), one 713m ² (7680 ft ²), one 691m ² (7436 ft ²), one 2715m ² (29,225 ft ²), two 1345m ² (14,480 ft ²), three 357m ² (3840 ft ²), all concrete, metal, metal roof, eight semipermanent, four permanent, one 267m ² (2872 ft ²), concrete, wood, dropsiding wallboard, rolled roof, temporary; repair shop, 891m ² (9594 ft ²), concrete, metal, metal roof, temporary; latrine, 80m ² (863 ft ²), concrete, metal, metal roof, semipermanent; gas station without building; diesel fuel station without building; general instruction building ₍₁₁₎ ; propane tanks; enlisted persons mess, 669m ² (7200 ft ²), concrete, metal, metal roof, temporary. Grader Operator Course (grid reference 742748): General instruction building ₍₁₇₎ . Crawler Tractor Course (grid reference 733749).	120	828790 to 828794	Communication cable: 16 pairs of 19 gage plastic coated wire (PC), wooden pole-mounted.
78	757754	Tank: Water Storage capacity 1,892,500L (500,000 gal), steel.	121	828790 to 829794	Powerline ₍₂₄₎ .
79	758759	Building: Facility engineering lumber and pipe shed, 457m ² (4917 ft ²), concrete, steel, temporary.	122	836782 to 843778	Powerline ₍₂₄₎ .
80	733766	Drivers Training Course (light vehicle), TA243.	123	839773 to 828790	Communication cable: 25 pairs of 22 gage PC, wooden pole-mounted.
81	735765	Mobility Training Course, TA243.	124	839775 to 825787	Powerline ₍₂₁₎ .
82	721741	Range 36 [Explosive Ordnance Disposal (E.O.D)]: Multi-use building, 21m ² (225 ft ²), all wood, asphalt shingle roof, temporary; three latrines, one, all wood, asphalt shingle roof, temporary, two latrines, fiberglass, temporary.	125	848784 to 850782	Powerline ₍₂₀₎ .
83	722733	Tower: Steel, permanent.	126	838764 to 839775	Powerline ₍₂₄₎ .
84	722726	Range 33 (Demolition): Applied instruction building, 581m ² (6250 ft ²), permanent; latrine ₍₅₎ ; six underground bunkers, permanent, safety distance 30m (980 ft), blasting area safety distance 680m (2230 ft).	127	807767 to 814771	Powerline, post internal distribution: Three-wire # 6 all copper, wooden pole-mounted.
85	725723	Building: Applied instruction building, 581m ² (6250 ft ²), concrete, metal, rolled roof, permanent.	128	809770 to 813772	Communication cable: Three pairs of 19 gage, wooden pole-mounted.
86	722708	Range 29 (Night Defense): Observation tower ₍₂₎ ; range training building ₍₃₃₎ ; target storage building, 28m ² (304 ft ²), concrete, wood, permanent; training course structure, concrete, metal, no walls, metal deck roof, semipermanent; flagpole.	129	808767 to 802771	Powerline ₍₂₅₎ .
87	718709	Range 30 (Fire Maneuver): Range house ₍₁₅₎ ; observation tower ₍₈₎ ; latrine ₍₅₎ ; target storage building ₍₁₄₎ ; shelter, 154m ² (1668 ft ²), concrete, metal, no walls, metal roof, semipermanent; bleachers; flagpole.	130	801770 to 807766	Communication cable: 100 pairs of 19 gage PIC, underground direct buried cable.
88	708709	Range 30A (Day Defense): Observation tower; two latrines ₍₅₎ ; multi-use building, concrete, wood, rolled roof, semipermanent; tent frame, wood.	131	807766 to 800761	Communication cable: Two pairs of copper weld wire, wooden pole-mounted.
89	700706	Cemetery, McCann.	132	801760 to 805763	Powerline ₍₂₄₎ .
90	726651	Abandoned Farm: Three buildings.	133	807767 to 814750	Powerline ₍₂₁₎ .
91	692670	Range 50 (Cannon Air to Ground, Conventional): Range house, 145m ² (1565 ft ²), permanent; two observation towers with range finders, both permanent; helipad, 148m ² (1602 ft ²) permanent.	134	812770 to 813754	Communication cable: 50 pairs of 19 gage PIC, underground direct buried cable.
92	691651	Abandoned Airfield (Airstrip No. 2): Approximate elevation, 349m (1145 ft) mean sea level, runway length 510m (1673 ft), width 30m (98 ft), azimuth 090°-270°, surface turfed, overgrown with grass or shrubs, no known obstructions.	135	810769 to 822765	Powerline ₍₂₄₎ .
93	669632	Cemetery, Macedonia.	136	812770 to 822765	Communication cable: 25 pairs of 19 gage PIC, underground direct buried cable.
94	664660	Building: Abandoned farm house.	137	778746 to 784750 781750 to 786746	Powerline ₍₂₄₎ .
95	704710	Mock Village.	138	766766 to 777766	Powerline ₍₁₉₎ .
96	705739	Bivouac Area, TA240: Building, all wood, asphalt single roof, temporary.	139	757746 to 767764	Powerline ₍₂₅₎ .
97	714744	Abandoned Airstrip (Babb Airfield, Airstrip 1): Approximate elevation 336m (1105 ft) mean sea level, runway length 1216m (3989 ft), width 58m (190 ft), azimuth 70°-250°, surface turfed, overgrown with grass or shrubs, poor condition, no known obstructions.	140	758754 to 764753	Powerline ₍₂₁₎ .
98	719753	Explosive Testing Site (owned by University of Missouri).	141	757746 to 792725	Powerline ₍₂₄₎ .
99	716757	Tank: Water.	142	778746 to 792725	Communication cable: One pair of copper weld wire, wooden pole-mounted.
100	732782	Civil Disturbance Training Area, TA231: Observation tower; mock village; latrine; storage building.	143	758753 to 762761	Powerline ₍₂₂₎ .
101	735792	Building: Latrine, all wood, rolled roof, temporary.	144	757746 to 778746	Range communication ₍₂₆₎ .
102	749797	Sanitary fill.	145	748743 to 757746	Range communication ₍₂₇₎ .
103	735811	Cemetery, Laughlin.	146	748712 to 747734	Range communication: 51 pairs of 10 gage lead covered cable (LC), wooden pole-mounted.
104	732817	Revetment.	147	746699 to 748712	Range communication: 50 pairs of 19 gage PC, wooden pole-mounted.
105	732825	Cemetery, Cedar Hill.	148	744676 to 746699	Range communication: 25 pairs of 19 gage PC, wooden pole-mounted.
106	729783	Abandoned Airstrip (Lucas Airstrip): Approximate elevation 335m (1100 ft) mean sea level, runway length 520m (1607 ft), width 60m (197 ft), azimuth 130°-310°, overgrown with grass and small shrubs.	149	749667 to 744676	Range communication: 18 pairs of 19 gage PIC, wooden pole-mounted.
107	696830 to 762829	Powerline ₍₁₈₎ .	150	748668 to 759664	Powerline ₍₂₄₎ .
108	765828 to 774826	Powerline ₍₁₈₎ .	151	759662 to 753657	Range communication line.
109	795833 to 776816	Powerline ₍₁₉₎ , Maries Circuit.	152	753650 to 749667	Range communication ₍₂₆₎ .
			153	748666 to 746706	Powerline, post internal distribution: Three-phase, 12,470V; four-wire # 1/0 all aluminum cable steel reinforced (ACSR), wooden pole-mounted.
			154	744691 to 733693	Range communication: Six pairs of copper weld wire, wooden pole-mounted.
			155	744691 to 733693	Powerline ₍₂₄₎ .
			156	747711 to 711709	Powerline ₍₂₈₎ .
			157	726711 to 729700	Powerline ₍₂₄₎ .
			158	729700 to 726711	Range communication: Two pairs of copper weld wire, wooden pole-mounted.
			159	748711 to 713712	Range communication: 18 pairs of 19 gage PC, wooden pole-mounted.
			160	746706 to 748715	Powerline ₍₂₈₎ .
			161	748715 to 749746	Powerline, post internal distribution: Three-phase 12,470V; four-wire # 3/0 (ACSR), wooden pole-mounted.
			162	747724 to 739723	Powerline ₍₂₄₎ .
			163	747724 to 739723	Range communication: Six pairs of 19 gage PIC, underground direct buried cable.
			164	747731 to 741732	Range communication: Three pairs, wooden pole-mounted.
			165	744732 to 739730	Powerline ₍₂₄₎ .
			166	747731 to 743732	Powerline ₍₂₄₎ .
			167	741731 to 741735	Powerline ₍₂₄₎ .
			168	747734 to 748743	Range communication ₍₂₇₎ .
			169	745748 to 737747	Powerline ₍₂₄₎ .
			170	757746 to 743754	Powerline ₍₂₅₎ .
			171	754751 to 756751	Communication cable ₍₂₃₎ .

L. NON-URBAN CULTURE FEATURES (Continued)

MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	REFERENCE	DESCRIPTION
172	743758 to 743750	Communication cable ⁽²⁹⁾ .	182	713712 to 710726	Range communication: 12 pairs of 19 gage PIC, underground direct buried cable.
173	756751 to 746755	Communication cable: 200 pairs, underground direct buried cable.	183	710726 to 706740	Range communication ⁽²⁶⁾ .
174	756746 to 758757	Communication cable: 50 pairs of 15 gage PC, wooden pole-mounted.	*184	(OFF-POST)	Recreation Area (Lake of the Ozark, Army Recreation Travel Camp): General administration building, 25m ² (266 ft ²), temporary; two enlisted persons barracks without mess, one 237m ² (2547 ft ²), permanent, one 116m ² (1250 ft ²), semipermanent; enlisted persons mess, 116m ² (1250 ft ²), semipermanent four latrines, two 37m ² (400 ft ²), one 13m ² (140 ft ²), one 18m ² (192 ft ²), two permanent, two semipermanent; recreation building, 203m ² (2190 ft ²), semipermanent; branch exchange 95m ² (1018 ft ²), permanent; snack bar, 68m ² (733 ft ²), temporary; bath house, 49m ² (532 ft ²), permanent; two facility engineering maintenance shops, one 111m ² (1200 ft ²), one 144m ² (1551 ft ²), both semipermanent; two general storehouses, one 21m ² (225 ft ²), temporary, one 37m ² (400 ft ²), permanent; small craft fuel building, 9.0m ² (100 ft ²), semipermanent.
175	757752 to 742754	Communication cable: 200 pairs, underground direct buried cable.			
176	758757 to 759760	Communication cable: 100 pairs of 19 gage, wooden pole-mounted.			
177	759760 to 767764	Communication cable: 100 pairs of 19 gage, underground direct buried cable.			
178	743750 to 742744	Communication cable: 22 pairs of 29 gage tape armored, underground direct buried cable.			
179	743758 to 740760	Communication cable: 12 pairs of 19 gage, underground direct buried cable.			
180	743754 to 734755	Powerline ⁽²⁴⁾ .			
181	746755 to 734755	Communication cable ⁽²⁹⁾ .			

FOOTNOTES:

- Subscript
Number
- (1) Multi-use building, 21m² (225 ft²), all wood, rolled roof, temporary.
 - (2) General administration building, 19m² (200 ft²), concrete, concrete block, rolled roof, temporary.
 - (3) Range house, 33m² (390 ft²), concrete, concrete block, built-up roof, permanent.
 - (4) Observation tower without range finder, concrete, metal, metal roof, permanent.
 - (5) Latrine, 126m² (1360 ft²), wood, steel, steel roof, semipermanent.
 - (6) Multi-use building, 158m² (1700 ft²), concrete, metal, metal roof, permanent.
 - (7) Multi-use building, concrete, metal, metal roof, permanent.
 - (8) Observation tower without range finder, concrete, steel, built-up roof, permanent.
 - (9) Latrine, 19m² (200 ft²), concrete, concrete block, rolled roof, temporary.
 - (10) Bleachers, gravel, metal, metal roof, permanent.
 - (11) General instruction building, 93m² (1000 ft²), concrete, metal/plywood, metal roof, semipermanent.
 - (12) Range house, 26m² (288 ft²), concrete, metal, metal roof, permanent.
 - (13) Observation tower without range finder, concrete, steel, metal roof, permanent.
 - (14) Target storage building, 28m² (304 ft²), concrete, wood, permanent.
 - (15) Range training building, 155m² (1668 ft²), concrete, concrete block, built-up roof, permanent.
 - (16) Equipment shelter, concrete, metal, no walls, metal roof, semipermanent.
 - (17) General instruction building, 134m² (1440 ft²), concrete, steel, steel roof, permanent.
 - (18) Powerline, Sho-Me Power Corporation: 161 kV transmission line (Waynesville Circuit); wooden two pole H-frame construction.
 - (19) Powerline, Sho-Me Power Corporation: 69 kV, 15,000 kVA, operates at 12,470V; all copper, wooden pole-mounted.
 - (20) Powerline, Sho-Me Power Corporation: 161 kV, wooden two-pole H-frame construction.
 - (21) Powerline, post internal distribution: Three-phase, 12,470V; four-wire # 6 all copper, wooden pole-mounted.
 - (22) Powerline, post internal distribution: Three-phase, 12,470V; four-wire # 4 all copper, wooden pole mounted.
 - (23) Communication cable: 50 pairs of 19 gage plastic insulated cable (PIC), wooden pole-mounted.
 - (24) Powerline, post internal distribution: Single-phase, 7200V; two wire # 6 all copper, wooden pole-mounted.
 - (25) Powerline, post internal distribution: Three-phase, 12,470V; four-wire # 1/10 all copper, wooden pole-mounted.
 - (26) Range communication: 12 pairs of 19 gage PIC, wooden pole-mounted.
 - (27) Range communication: 51 pairs of 19 gage lead covered cable (LC), wooden pole-mounted.
 - (28) Powerline, post internal distribution: Three-wire # 1/0 all aluminum cable steel reinforced (ACSR), wooden pole-mounted.
 - (29) Communication cable: 12 pairs of 19 gage PIC, wooden pole-mounted.
 - * Located off post, approximately 64km (40 mi) northwest of cantonment area.



FORT LEONARD WOOD, MISSOURI TERRAIN ANALYSIS

NON-URBAN CULTURE FEATURES

- | | | | |
|--|--------------------|--|--|
| | Abandoned airstrip | | Tower, use unknown |
| | Power substation | | Pumping station |
| | Cemetery | | Powerline |
| | Sanitary landfill | | Telephone line (underground) |
| | Tank (water) | | Telephone line |
| | Training area | | Ammunition bunker |
| | Observation tower | | Ammunition dump |
| | Building | | Sewage treatment plant |
| | Mock village | | Petroleum disposal area |
| | Storage area | | Recreation area |
| | Revetment | | Denotes change in powerline or telephone line configuration. |
| | Ruins | | |

III. OFF-POST FEATURES

Off-post features in this study are limited to airfields and urban areas within an 80.4 kilometer (50 mile) radius and ports within a 160.9 kilometer (100 mile) radius of Fort Leonard Wood. The location of the airfields and urban areas are shown on the accompanying map. The ports, however, are shown in tabular form only.

The nine counties in and around the Fort Leonard Wood area are similar in size, population density, culture, topography, and economy. The study area is predominantly rural in nature with small urban areas scattered throughout. Agriculture and light industry are the mainstays of the area's economy. The prospect of additional light industrialization seems bright, especially with the area's growing economy, increasing electrical power, and access provided to major markets and support services by Interstate 44.

There are two major electrical power generators and distributors in south-central Missouri, Union Electric Power Corporation, a privately owned utility and Associated Electric Cooperative, Inc. Union Electric, the larger of the two, has a total power capacity of 6524 MW. Associated Electric has an approximate power capability of 2332 MW. Both suppliers provide power through hydroelectric and coal fired generation. The addition of two nuclear power plants, Callaway (owned by Union Electric) in 1983 near Fulton, Missouri, with a generating capacity of 1150 MW, and Black Fox in Oklahoma in 1986 will greatly increase the region's power availability.

Though the area around Fort Leonard Wood is somewhat remote and lacks large population centers, there are abundant recreational resources in the region which are important economic factors. The main tourist center is the Lake of the Ozarks located approximately 64 kilometers (40 miles) northwest of the reservation. The lake offers a resort-like atmosphere including such activities as swimming, boating, lodging, camping, hiking, and spelunking. The active duty military population stationed at the reservation is also important to the area's growing economy. The retired military personnel locate in the area to take advantage of climate, open spaces, and the availability of army medical services, commissary, and exchange facilities. Not only do the military and retired military populations bolster the area's economy, the reservation itself is one of the area's largest employers of civilians.

AIRFIELDS

There are two airports within an 80.4 kilometer (50 mile) radius of Fort Leonard Wood that will support aircraft as large as the C-130 Hercules and larger on a limited basis. The first, Lee C. Fine Memorial Airport, is approximately 17.6 kilometers (11 miles) northeast of Camdenton, Missouri and 50.4 kilometers (31.4 miles) northwest of the reservation. The second, Rolla National Airport, is approximately 18.5 kilometers (11.5 miles) north of Rolla, Missouri and 50.4 kilometers (31.5 miles) northeast of the reservation. The Air Defense Command (ADC) maintains an active radar station at Rolla National.

URBAN AREAS

There are seven urban areas with populations of 2500 or greater within an 80.4 kilometers (50 mile) radius of Fort Leonard Wood, Missouri. They range in size from 2879 for Waynesville, Missouri to 13,303 for Rolla, Missouri, the largest city of the study area.

The accompanying tables present data for population, housing, education, medical and recreation facilities, and public utilities. The most recent available data were used to compile the tables.

PORTS

River terminals along the Missouri River within the 160.9 kilometer (100 mile) radius of the study area do not handle ocean-going vessels. Therefore, port facilities are not shown on the accompanying map. However, the ports are shown on a commercial river terminals and facilities chart.

Commercial navigation on the Missouri River is seasonal, normally from late March to late November at Sioux City, Iowa, and from early April to early December at the mouth. Ice conditions and low water preclude navigation the rest of the year. During the navigation season, river stages vary from a range of about 0.3 meter (1.0 foot) at Sioux City, Iowa to around 4.5 meters (15 feet) at Hermann, Missouri. The continuous navigation channel maintained by the Corps of Engineers is 2.7 meters (9.0 feet) deep and 91 meters (300 feet) wide.

A. AIRFIELDS

NAME; LOCATION; CLASSIFICATION; AND TYPE	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
Lee C. Fine Memorial Airport; 38° 06'N, 92° 33'W; Civil; Airfield	265m (869 ft); Operational.	North-South Runway 03-21 1980 x 30m (6494 x 100 ft); azimuth 034° - 214°; maximum weight bearing capacity S55, T70, ST89, TT215*; asphalt surface; good condition.	<u>Taxiway</u> One, 23m (75 ft) wide; weight bearing capacities are the same as associated runway; concrete over- laid with asphalt surface; good condition. <u>Parking Apron and Hardstand Area</u> 33,444m² (360,000 ft²) approxi- mate total area; maximum weight bearing capacity same as runway; concrete surface; good condition.	<u>Hangars</u> None <u>Maintenance Facilities</u> None <u>Administration and Terminal Building</u> One, approximate area 465m² (5000 ft²). <u>Other Buildings</u> Fire house; wood construction.	<u>Tanks</u> Jet fuel, type A50: underground storage, total capacity 136,260 L (360,000 gal). Aviation gasoline, type grade 100 L.L. octane: under- ground storage, total capacity 90,840 L (24,000 gal). <u>Trucks</u> One truck for jet fuel Type A50, total capacity 3028 L (800 gal). One truck for aviation gasoline. Single point and overwing re- fueling capacity.	<u>Control Tower</u> None <u>Navigational and Landing Aids</u> VOR/DME; NDB; UNICOM frequency 122.800; wind indicator. <u>Lights</u> Clear and green rotating beacon; medium intensity runway lights; visual approach slope indicator systems.	Attendance April through November 0700-2100 daily. Attendant lives on airport. Flight service information (VICHY) call 314-299-4291 or 800-392-0820.
Rolla National Airport; 38° 07'N, 91° 46'W; Civil; Airfield	418m (1370 ft); Operational.	<u>Northeast-Southwest Runway 04-22</u> 1676 x 46m (5499 x 150 ft); azimuth 038° - 218°; maximum weight bearing capacity S75, T85, ST 108, TT130*; asphalt underlaid with concrete surface; fair condition. <u>Northwest-Southeast Runway 13-31</u> 1676 x 46m (5499 x 150 ft); azimuth 130° - 310°; maximum weight bearing capacity S54, T68, TT 100*; asphalt underlaid with concrete surface; fair condition.	<u>Taxiway</u> One, parallel and link type; 15m (50 ft) wide; weight bearing capaci- ties same as associated runways; concrete; fair condition. <u>Parking Apron and Hardstand Area</u> 21,739m² (234,000 ft²) approxi- mate total area; maximum weight bearing capacity same as runways.	<u>Hangars</u> Three hangars being used for air- port maintenance and storage. One, approximate area 2007m² (21,600 ft²); one, approximate area 145m² (1560 ft²); one, approximate area 1115m² (12,000 ft²); all are con- crete, frame, good condition. <u>Maintenance Facilities</u> One Federal Aviation Adminis- tration maintenance building, approximate area 93m² (1000 ft²), concrete, frame; one machine shop, approximate area 325m² (3500 ft²), concrete, metal pre-fab; one 5-bay garage, approximate area 145m² (1560 ft²), concrete, frame; one garage, approximate area 91m² (975 ft²), concrete, frame; all maintenance facilities buildings in good condition. Major airframe and power plant repairs conducted in hangars listed above. <u>Administration and Terminal Buildings</u> Terminal, approximate area 145m² (1560 ft²), concrete, frame; airport offices, approximate area 177m² (1900 ft²), concrete, frame, and brick; Flight Service Station (FSS), approximate area 163m² (1750 ft²), wood, frame; all three buildings in good condition. <u>Other Buildings</u> Two storage buildings; one, approx- imate area 84m² (900 ft²), con- crete, frame, and gypsum; one, approximate area 33m² (350 ft²), concrete, frame; both good condition.	<u>Tanks</u> Jet fuel, Type A and low lead fuel, grade 100 octane stored in airport fuel tank farm. Automotive fuel 3785 L (1000 gal) capacity in storage tanks.	<u>Control Tower</u> None <u>Navigational and Landing Aids</u> VORTAC; VHF/DF, contact FSS. <u>Lights</u> Clear and green rotating beacon; red approach lights; runway 04-22 has high intensity edge lights; runway 13-31 has medium inten- sity edge lights; both runways have visual approach slope indicator systems.	Attendance year round 0800-1700 daily. Flight Service Station (VICHY) located at airport. For flight service information call 314-299-4291 or 800-392-0820. Trees cause runway 04/22 to have limited obstruction 201m (660 ft) from end of runway. Sign, height 6.0m (19 ft), and trees cause run- way 13/31 to have obstruction 176m (580 ft) and 198m (650 ft) respectively from the end of run- ways. Tower, height 30m (97 ft), located 549m (1800 ft) north- northeast of runway 31. Runways have cracks full length; taxiway and apron with cracks and spalling. For runway lights, contact Flight Service Station.

*Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.
S- Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F100).
T- Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).
ST- Runway weight bearing capacity for aircraft with single-tandem type landing gear (C-130).
TT- Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135). For further information, see DOD Flight Information Publication (enroute IFR- Supplement United States).

III. OFF-POST FEATURES (Continued)

B. URBAN AREAS

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Eldon, MO (Miller County) 38° 21'N 92° 35'W	1980 Census: 4342 1990 Projection: 4800	<u>Single-Family Units</u> Total units: 1990 Housing rental units: 450 Average monthly rent: \$240 Vacancy rate: 3 percent New house starts: 25 Number of sales: 180 Average sale price: \$40,000 <u>Multi-Family Units</u> Total units: 200 Total vacant units: No data Vacancy rate: No data Average monthly rent: a. Efficiency: \$90 b. 1 bedroom: \$110 c. 2 bedroom: \$135 d. 3 bedroom: \$160	<u>Elementary Schools</u> Number of schools: 1 Enrollment capacity: 800 1980/81 enrollment: 676 1990 projection: 750 <u>Junior High Schools</u> Number of schools: 1 Enrollment capacity: 700 1980/81 enrollment: 541 1990 projection: 600 <u>Secondary Schools</u> Number of schools: 1 Enrollment capacity: 600 1980/81 enrollment: 675 1990 projection: 600 <u>Vocational Schools</u> Number of schools: 1 Enrollment capacity: 250 1980/81 enrollment: 194 1990 projection: 225	<u>Doctors</u> Total: 2 Doctor/population ratio: 1/2171 <u>Dentists</u> Total: 3 Dentist/population ratio: 1/1447 <u>Health Care Facilities</u> Nearest hospital 26km (16.2 mi) at Osage Beach, MO Lake of the Ozarks Hospital. Inpatient services (no. of beds): Medical-surgical: 78 Obstetric: 6 Intensive care (mixed ICU/CCU): 6 Total beds: 90 <u>Nursing Home</u> Total beds: 60	Parks: 3 Athletic Fields: 4 Tennis Courts: 4 Golf Courses: 1	<u>Electric Power</u> Source of supply: Missouri Utilities, Three Rivers Electric Cooperative Generating demand for Missouri Utilities : Approximate daily demand: 30 MW Peak demand: 42 MW Generating demand for Three Rivers Electric Cooperative: Approximate daily demand: 2300 kW Peak demand: 4600 kW Supply: Adequate Future expansion: Missouri Utilities anticipates a 12,470 volt transformer (7500 kVA) at one substation. <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: 1 trickling filter (secondary treatment), 7 lagoons. Design capacity: 1.9 x 10 ⁶ Lpd (0.5 x 10 ⁶ gpd) Average daily flow: 1.9 x 10 ⁶ L (0.5 x 10 ⁶ gal). Future expansion: Oxidation ditch, on-line in spring 1982. <u>Heating Fuel</u> Sources of products: Natural gas from Missouri Utilities; propane, oil and wood from local distributors Supply: Adequate <u>Water Supply</u> Sources: Five City wells Treatment plant capacity: 4.9 x 10 ⁶ Lpd (1.3 x 10 ⁶ gpd) Reservoir capacity: 4.9 x 10 ⁶ L (1.3 x 10 ⁶ gal) Average daily consumption: 1.5 x 10 ⁶ L (0.4 x 10 ⁶ gal) Peak daily consumption: 2.3 x 10 ⁶ L (0.6 x 10 ⁶ gal) Future expansion: Two additional wells and one storage tank.
Lebanon, MO (Laclede County) 37° 41'N 92° 40'W	1980 Census: 9507 1990 Projection: 11,500	<u>Single-Family Units</u> Total units: 4269 Housing rental units: 1169 Average monthly rent: \$250 Vacancy rate: 5 percent New house starts: 38 Number of sales: 125 Average sale price: \$43,000 <u>Multi-Family Units</u> Total units: 350 Total vacant units: No data Vacancy rate: No data Average monthly rent: a. Efficiency: \$100 b. 1 bedroom: \$120 c. 2 bedroom: \$145 d. 3 bedroom: \$170 e. 4 bedroom: \$200	<u>Elementary Schools</u> Number of schools: 4 Enrollment capacity: 2000 1980/81 enrollment: 1703 1990 projection: 1800 <u>Junior High Schools</u> Number of schools: 1 Enrollment capacity: 900 1980/81 enrollment: 674 1990 projection: 900 <u>Secondary Schools</u> Number of schools: 1 Enrollment capacity: 1000 1980/81 enrollment: 876 1990 projection: 900 <u>Vocational Schools</u> Number of schools: 1 Enrollment capacity: 500 1980/81 enrollment: 377 1990 projection: 450 <u>Private Schools</u> Number of schools: 1 (Pre-school only, ages 3 through 5) Enrollment capacity: 50 1980/81 enrollment: 40 1990 projection: 50	<u>Doctors</u> Total: 8 Doctor/population ratio: 1/1188 <u>Dentists</u> Total: 13 Dentist/population ratio: 1/731 <u>Health Care Facilities</u> Breech Medical Center, Lebanon, MO Inpatient services (no. of beds): Medical-surgical: 79 Pediatric: 4 Obstetric: 6 Intensive care (mixed ICU/CCU): 4 Total beds: 93 <u>Nursing Homes</u> Total beds: 287	Parks: 8 Athletic Fields: 11 Tennis Courts: 4 Golf Courses: 1	<u>Electric Power</u> Source of supply: Sho-Me Power Corporation Generating demand: Approximate daily demand: 200 MW Peak demand: 420 MW Supply: Adequate Future expansion: addition of transmission lines <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: Mechanical Design capacity: 8.5 x 10 ⁶ Lpd (2.2 x 10 ⁶ gpd) Average daily flow: 3.8 x 10 ⁶ L (1.0 x 10 ⁶ gal) Future expansion: None <u>Heating Fuel</u> Sources of products: Propane, oil and wood from local distributors Supply: Adequate <u>Water Supply</u> Sources: City wells and reservoir with 11.4 x 10 ⁶ L (3.0 x 10 ⁶ gal) capacity. Future expansion: None
Mountain Grove, MO (Wright County) 37° 7'N 92° 16'W	1980 Census: 3974 1990 Projection: 4571	<u>Single-Family Units</u> Total units: 1825 Housing rental units: 1442 Average monthly rent: \$90 Vacancy rate: 4.2 percent New house starts: 32 Number of sales: 300 Average sale price: \$30,000 <u>Multi-Family Units</u> Total units: 201 Total vacant units: No data Vacancy rate: No data Average monthly rent: a. Efficiency: \$90 b. 1 bedroom: \$130 c. 2 bedroom: \$185 d. 3 bedroom: \$250 e. 4 bedroom: \$300	<u>Elementary Schools</u> Number of schools: 1 Enrollment capacity: 1000 1980/81 enrollment: 800 1990 projection: 750 <u>Junior and Senior High Schools Combined</u> Number of schools: 1 Enrollment capacity: 1100 1980/81 enrollment: 900 1990 projection: 850 <u>Vocational Schools</u> Number of schools: 1 Enrollment capacity: 250 1980/81 enrollment: 200 1990 projection: 200	<u>Doctors</u> Total: 2 Doctor/population ratio: 1/1987 <u>Dentists</u> Total: 2 Dentist/population ratio: 1/1987 <u>Health Care Facilities</u> Nearest hospital 29km (18 mi) at Mansfield, MO Tricounty Health Facility. Inpatient services (no. of beds): Medical-surgical: 41 Obstetric: 6 Intensive care (mixed ICU/CCU): 4 Total beds: 51 <u>Nursing Homes</u> Total beds: 82	Parks: 3 Athletic Fields: 3 Tennis Courts: 2 Golf Courses: 1	<u>Electric Power</u> Source of supply: Sho-Me Power Corporation Generating demand: Approximate daily demand: 200 MW Peak demand: 420 MW Supply: Adequate Future expansion: None <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: Lagoon Design capacity: No data Average daily flow: No data Future expansion: No data <u>Heating Fuel</u> Sources of products: Propane, oil and wood from local distributors Supply: Adequate <u>Water Supply</u> Source: Wells Treatment plant capacity: Serves 3400 population Reservoir capacity: 13 acres Future expansion: None

III. OFF-POST FEATURES (Continued)

B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Rolla, MO (Phelps County) 37° 57'N 91° 47'W	1980 Census: 13,303 1990 Projection: 13,800	<u>Single-Family Units</u> Total units: 4855 Housing rental units: 2135 Average monthly rent: \$250 Vacancy rate: 1.0 percent New house starts: 53 Number of sales: 12 Average sale price: \$55,000 <u>Multi-Family Units</u> Total units: 700 Total vacant units: 6 Vacancy rate: 1.0 percent Average monthly rent: a. Efficiency: \$150 b. 1 bedroom: \$230 c. 2 bedroom: \$275 d. 3 bedroom: \$315 e. 4 bedroom: \$360	<u>Elementary Schools</u> Number of schools: 4 Enrollment capacity: No data available 1980/81 enrollment: 2302 1990 projection: 2000 <u>Junior High Schools</u> Number of schools: 1 Enrollment capacity: No data available 1980/81 enrollment: 668 1990 projection: 500 <u>Secondary Schools</u> Number of schools: 1 Enrollment capacity: No data available 1980/81 enrollment: 1040 1990 projection: 760 <u>Special Education Schools</u> Number of schools: 2 Enrollment capacity: 60 1980/81 enrollment: 88 1990 projection: 100 <u>Vocational Schools</u> Number of schools: 1 Enrollment capacity: No data available 1980/81 enrollment: 466 1990 projection: 350 <u>Private Schools</u> There are five private schools in Rolla. One has students in grades K through 6, one K through 12, one 1 through 8. No data available for the remaining two schools. Enrollment capacity: No data available 1980/81 enrollment: 278 1990 projection: No data available <u>Higher Education Schools</u> University of Missouri (under-graduate through Ph.D. curric- ulums in Arts and Sciences and Engineering) Enrollment capacity: 6000 1980/81 enrollment: 5400 1990 projection: 6000	<u>Doctors</u> Total: 20 Doctor/population ratio: 1/665 <u>Dentists</u> Total: 9 Dentist/population ratio: 1/1478 <u>Health Care Facilities</u> Phelps County Memorial Hospital, Rolla, MO Inpatient services (no. of beds): Medical-surgical: 199 Pediatric: 14 Obstetric: 18 Intensive care (mixed ICU/CCU): 8 Long term nursing: 32 Total beds: 271 <u>Nursing Homes</u> Total beds: 190	Parks: 11 Athletic Fields: 7 Tennis Courts: 15 Golf Courses: 1	<u>Electric Power</u> Source of supply: Rolla Municipal Generating demand: Approximate daily demand: 2500 kW Peak demand: 300 kW Supply: Adequate Future expansion: None <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: Treatment plant and air filtration system Design capacity: 15.1 x 10 ⁶ Lpd (4.1 x 10 ⁶ gpd) Average daily flow: 7.9 x 10 ⁶ L (2.1 x 1.0 ⁶ gal) Future expansion: None <u>Heating Fuel</u> Sources of products: Propane, oil and wood from local distributors Supply: Adequate 2 Oil distributors <u>Water Supply</u> Sources: 13 City deep wells Treatment plant capacity: 48.0 x 10 ⁶ Lpd (12.8 x 10 ⁶ gpd) Future expansion: Additional storage tanks and main lines.
St. James, MO (Phelps County) 37° 59'N 91° 48'W	1980 Census: 3328 1990 Projection: 3727	<u>Single-Family Units</u> Total units: 1328 Housing rental units: 400 Average monthly rent: \$150 Vacancy rate: 1 percent New house starts: 15 Number of sales: 12 Average sale price: \$55,000 <u>Multi-Family Units</u> Total units: 125 Total vacant units: 10 Vacancy rate: 8 percent Average monthly rent: a. Efficiency: \$100 b. 1 bedroom: \$130 c. 2 bedroom: \$150 d. 3 bedroom: \$180 e. 4 bedroom: \$200	<u>Elementary Schools</u> Number of schools: 1 Enrollment capacity: 800 1980/81 enrollment: 550 1990 projection: 500 <u>Junior High Schools</u> Number of schools: 1 Enrollment capacity: 250 1980/81 enrollment: 200 1990 projection: 275 <u>Secondary Schools</u> Number of schools: 1 Enrollment capacity: 600 1980/81 enrollment: 475 1990 projection: 550	<u>Doctors</u> Total: 2 Doctor/population ratio: 1/1664 <u>Dentists</u> Total: 1 Dentist/population ratio: 1/3328 <u>Health Care Facilities</u> Nearest hospital 15.2km (9.5 miles) at Rolla, MO	Parks: 3 Athletic Fields: 8 Tennis Courts: 3 Golf Courses: 1	<u>Electric Power</u> Source of supply: Union Electric Power Corporation Generating capacity: 6524 MW Supply: Adequate Future expansion: None <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: Oxidation ditch Design capacity: 1.9 x 10 ⁶ Lpd (0.5 x 10 ⁶ gpd) Average daily flow: 1.1 x 10 ⁶ L (0.3 x 10 ⁶ gal) Future expansion: None <u>Heating Fuel</u> Sources of products: Propane, oil and wood from local distributors Supply: Adequate <u>Water Supply</u> Source: City well Reservoir capacity: No data Future expansion: None
Salem, MO (Dent County) 37° 38'N 91° 32'W	1980 Census: 4454 1990 Projection: 4545	<u>Single-Family Units</u> Total units: 2201 Housing rental units: 250 Average monthly rent: \$200 Vacancy rate: 11 percent New house starts: 75 Number of sales: 50 Average sale price: \$45,000 <u>Multi-Family Units</u> Total units: 200 Total vacant units: 5 Vacancy rate: 3 percent Average monthly rent: a. Efficiency: \$125 b. 1 bedroom: \$150 c. 2 bedroom: \$175 d. 3 bedroom: \$225 e. 4 bedroom: \$250	<u>Elementary Schools</u> Number of schools: 5 Enrollment capacity: 2125 1980/81 enrollment: 1974 1990 projection: 2084 <u>Junior High Schools</u> Number of schools: 1 Enrollment capacity: 475 1980/81 enrollment: 333 1990 projection: 453 <u>Secondary Schools</u> Number of schools: 1 Enrollment capacity: 700 1980/81 enrollment: 608 1990 projection: 720 <u>Private Schools</u> Number of schools: 1 (Pre-school only, ages 3 through 5) Enrollment capacity: 100 1980/81 enrollment: 55 1990 projection: 200	<u>Doctors</u> Total: 5 Doctor/population ratio: 1/891 <u>Dentists</u> Total: 2 Dentist/population ratio: 1/2227 <u>Health Care Facilities</u> Salem Memorial District Hospital, Salem, MO Inpatient services (no. of beds): Medical-surgical: 42 Obstetric: 4 Other acute: 4 Total beds: 50 <u>Nursing Homes</u> Total beds: 146	Parks: 1 Athletic Fields: 2 Golf Courses: 1	<u>Electric Power</u> Source of supply: Sho-Me Power Corporation Generating demand: Approximate daily demand: 200 MW Peak demand: 420 MW Supply: Adequate Future expansion: None <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: Oxidation ditch Design capacity: 1.9 x 10 ⁶ Lpd (0.5 x 10 ⁶ gpd) Average daily flow: 1.6 x 10 ⁶ L (0.42 x 10 ⁶ gal) Future expansion: None <u>Heating Fuel</u> Sources of products: Propane, oil and wood from local distributors Supply: Adequate 10 Heating fuel distributors <u>Water Supply</u> Sources: City wells Reservoir capacity: 0.85 x 10 ⁶ L (0.23 x 10 ⁶ gal) Future expansion: Expand reservoir to 1.9 x 10 ⁶ L (0.5 x 10 ⁶ gal) capacity.

III. OFF-POST FEATURES (Continued)

B. URBAN AREAS(Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Waynesville, MO (Pulaski County) 37° 49'N 92° 10'W	1980 Census: 2879 1990 Projection: No data	<u>Single-Family Units</u> Total units: 1225 Housing rental units: 382 Average monthly rent: \$175 Vacancy rate: 5 percent New house starts: 17 Number of sales: 180 Average sale price: \$40,000 <u>Multi-Family Units</u> Total units: 160 Total vacant units: 20 Vacancy rate: 12.5 percent Average monthly rent: a. Efficiency: \$100 b. 1 bedroom: \$180 c. 2 bedroom: \$225	<u>Elementary Schools</u> Number of schools: 7 Enrollment capacity: 4080 1980/81 enrollment: 2744 1990 projection: 3000 <u>Junior High Schools</u> Number of schools: 2 Enrollment capacity: 1590 1980/81 enrollment: 1084 1990 projection: 1150 <u>Secondary Schools</u> Number of schools: 1 Enrollment capacity: 1230 1980/81 enrollment: 760 1990 projection: 900 <u>Vocational Schools</u> Number of schools: 1 Enrollment capacity: 500 1980/81 enrollment: 358 1990 projection: 400	<u>Doctors</u> Total: 10 Doctor/population ratio: 1/288 <u>Dentists</u> Total: 1 Dentist/population ratio: 1/2879 <u>Health Care Facilities</u> Pulaski County Memorial Hospital, Waynesville, MO Inpatient services (no. of beds): Medical-surgical: 47 Intensive care (mixed ICU/CCU): 3 Total beds: 50 <u>Nursing Homes</u> Total beds: 42	Parks: 2 Athletic Fields: 4 Tennis Courts: 2	<u>Electric Power</u> Source of supply: Sho-Me Power Corporation Generating demand: Approximate daily demand: 200 MW Peak demand: 420 MW Supply: Adequate Future expansion: None <u>Sewage Disposal</u> Number of facilities: 1 Type of treatment: Oxidation Design capacity: 4.5 x 10 ⁶ Lpd (1.2 x 10 ⁶ gpd) Average daily flow: 2.4 x 10 ⁶ L (0.63 x 10 ⁶ gal) Future expansion: None <u>Heating Fuel</u> Sources of products: Propane, oil and wood from local distributors Supply: Adequate <u>Water Supply</u> Sources: City wells Treatment plant capacity: 7.2 x 10 ⁶ Lpd (1.9 x 10 ⁶ gpd) Future expansion: None

C. PORTS

COMMERICAL RIVER TERMINALS AND FACILITIES CHART

NAME	LOCATION	MILE ¹	BANK ²	TYPE FACILITY	OPERATOR ADDRESS
Missouri River Sand Co.	Boonville, MO	197.0	R	Transfer of sand and gravel	P.O. Box 598, Columbia, MO
Interstate Marine Terminal	Boonville, MO	196.4	L	Fertilizer unloading	512 Spring, Boonville, MO
Medusa Aggregates Co.	Huntsdale, MO	181.4	L	Transfer of sand and gravel	P.O. Box 1085, Burlington, IA
American Oil Co.	Jefferson City, MO	148.6	L	Oil unloading	P.O. Box 6110-A, Chicago, IL
Capitol Sand Co.	Cedar City, MO	143.7	L	Transfer of sand and gravel	P.O. Box 156, Cedar City, MO
		143.2	L		
Calloway County Sand Co.	Mokane, MO	124.6	L	Transfer of sand and gravel	P.O. Box 125, Mokane, MO
Central Electric Power Co-op	Chamolis, MO	117.1	R	Coal unloading	907 W. Dunklin St., Jefferson City, MO
Two Rivers Sand and Gravel Co.	Hermann, MO	96.6	L	Transfer of sand and gravel	1421 S. Washington St., Hermann, MO
Maczuk Industries	New Haven, MO	81.8	R	Loading dock	New Haven, MO
Washington Sand Co.	Washington, MO	68.2		Transfer of sand and gravel	819 Locust St., Washington, MO
St. Charles Sand Co.	Chesterfield, MO	43.8	R	Transfer of sand and gravel	Route 1, Box 158, Hazelwood, MO

¹ Mileage is measured upstream from the confluence of the Missouri and Mississippi Rivers, Mile 0.0
² R - right bank, L - left bank, looking downstream towards confluence of Missouri and Mississippi Rivers

IV. LIST OF SOURCES

DOCUMENTS

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4. **AIRPORT/FACILITY DIRECTORY: NORTHCENTRAL U.S.** Effective 16 April 1981 to 11 June 1981. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Washington, DC. (III A)
5. **AIRPORT MASTER RECORD (FAA FORM 5010-1), FORNEY, AAF.** July 1981. Department of Transportation, Federal Aviation Administration, Washington, DC. (II J)
6. **AIRPORT MASTER RECORD (FAA FORM 5010-1), LEE C. FINE MEMORIAL AIRPORT.** July 1981. Department of Transportation, Federal Aviation Administration, Washington DC. (III A)
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8. **AOPA'S HANDBOOK FOR PILOTS.** 1981. Aircraft Owners and Pilots Association, Washington, DC. (II J, III A)
9. **ARMY COMMUNITY SERVICE INSTALLATION FACT SHEET, FORT LEONARD WOOD, MISSOURI.** July 1978. U.S. Army, Fort Leonard Wood, MO. (III B)
10. **AVIATION WEATHER.** 1965. U.S. Department of Commerce, Federal Aviation Agency, Weather Bureau, Washington, DC. (II H)
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PERSONAL COMMUNICATIONS

129. Mr. Ferris Allgood. 1 September 1981. U.S. Department of Agriculture, Soil Conservation Service, Columbia, MO. Telephone conversation concerning soils analysis on Fort Leonard Wood.

130. Mr. Andrews. 1 October 1981. Lee C. Fine Memorial Airport, Kaiser, MO. Telephone conversation concerning runway weight bearing capacity.

131. Mr. Banse. 30 September 1981. Rolla Municipal Utilities, Rolla, MO. Telephone conversation concerning electrical power capacity.

132. Mr. Dave Barnes. 2 September 1981. Chief, Instructional Services, Fort Leonard Wood, MO. Telephone conversation concerning Truman Education Center enrollment.

133. Mr. Henry Beezley. July 1981. Mayor of Salem, MO. Letter and questionnaire requesting urban socioeconomic statistics.

134. Mr. Ray Bohm. 24 July 1981. Geologist, Missouri Geological Survey, Rolla, MO. Telephone conversation concerning earthquake and special phenomena in the south-central Missouri area.

135. Mr. Patrick Brugger. July-August 1981. Building and Structures Branch, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Telephone conversation concerning roads and pavements documents and ford locations on post.

136. Mr. Thomas Burke. 2 July 1981. River Development, U.S. Army Engineer District, Kansas City, MO. Telephone conversation concerning location of ports along Missouri River.

137. Ms. Darlene Carter. June 1981. Federal Aviation Administration, Washington, DC. Telephone conversation concerning airport facilities information.

138. Mr. L. Claiborne. 19 June 1981. Superintendent, Waynesville Public School System, Waynesville, MO. Telephone conversation concerning school enrollment of military dependents.

139. Mr. Paul Cope. July 1981. Park Superintendent, Lee C. Fine Memorial Airport, Kaiser, MO. Letter concerning airport facilities information.

140. Mr. Kenneth E. Cowan. June 1981. Mayor of Lebanon, MO. Letter and questionnaire concerning urban socioeconomic statistics.

141. Mr. Marshall Dake. 19 June 1981. Frontier Airlines, Forney Army Airfield, Fort Leonard Wood, MO. Interview concerning status of airline activities.

142. Mr. Tom Deahner. 30 September 1981. Public Relations, Union Electric Power Corporation, St. Louis, MO. Telephone conversation concerning electrical power capacity.

143. LT Delottinville. 19 June 1981. School Liaison Officer, Personnel Service Division, Directorate of Personnel and Community Activities, Fort Leonard Wood, MO. Telephone conversation concerning schools off-post.

144. Mr. Richard Dobie. 30 July 1981. U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center (ETL/TAC), Fort Belvoir, VA. Telephone conversation concerning vegetation mapping.

145. Mr. K.J. Duddridge. 17 June 1981. Engineer and Services Branch, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning status of airport runway resurfacing, Bloodland Lake, and water resources on post.

146. Mr. William Elder. July-August 1981. Office of Social and Economic Data Analysis, University of Missouri, Columbia, MO. Telephone conversation and letters concerning data acquisition for off-post urban areas.

147. Ms. Lou McFarland. June 1981. Mayor of Rolla, MO. Letter and questionnaire concerning urban socioeconomic statistics.

148. Mr. Fillmer. 30 September 1981. Sho-Me Power Corporation, Marshfield, MO. Telephone conversation concerning electrical power capacity.

149. Mr. Robert L. Fuerst. June-September 1981. Environmental and Planning Branch, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interviews and telephone conversations concerning data acquisition for various topics.

150. Mr. John Grinstead. June-October 1981. Forester, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interviews and telephone conversations concerning data acquisition for various topics, and assistance with field reconnaissance.

151. Mr. Nelson Hart. June 1981. Mayor of St. James, MO. Letter and questionnaire concerning urban socioeconomic statistics.

152. SSG Gary Heckathorn. June 1982. Instructor in Quarry Operators Training Course, Fort Leonard Wood, MO. Interview concerning quality and uses of aggregate produced at Fort Leonard Wood.

153. Mr. James W. Henson. June 1981. Line Supervisor, Electrical Branch, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning electrical distribution on post.

154. Ms. Beth Hester. 3 August 1981. Coordinator, Child Support Services, Fort Leonard Wood, MO. Telephone conversation concerning child care facilities on post.

155. Mr. Dennis Hicks. 30 September 1981. Associated Electric, Springfield, MO. Telephone conversation concerning electrical power capacity.

156. Mr. Gilbert Hinkelmeier. 30 September 1981. Three Rivers Electrical Cooperative, Eldon, MO. Telephone conversation concerning electrical power capacity.

157. Mr. John Holland. July 1981. Mayor of Eldon, MO. Letter and questionnaire concerning urban socioeconomic statistics.

158. Mr. Joe Hylton. June 1981. Mayor of Mountain Grove, MO. Letter and questionnaire concerning urban socioeconomic statistics.

159. Mr. Rick Jarvis. July-September 1981. Real Property Officer, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Letter, interview, and telephone conversations concerning the location and type of structures and buildings on the reservation.

160. Mr. Charles Jordan. September 1981. Master Planning, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Telephone conversation concerning number of dentists on post.

161. Mr. Robert Knight. July 1981. Missouri Department of Natural Resources, Rolla, MO. Interview concerning wells at Fort Leonard Wood.

162. Mr. Ted Knipp. 30 September 1981. Missouri Utilities, Linn, MO. Telephone conversation concerning electrical power capacity.

163. Mr. Jack Koll. June 1981. U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center (ETL/TAC), Fort Belvoir, VA. Telephone conversation concerning inclusion of U.S. Army recreation area at Lake of the Ozarks in Fort Leonard Wood terrain study.

164. Mr. Larry Lewis. U.S. Department of Agriculture, Soil Conservation Service, Camdenton, MO. Interview concerning water resources.

165. Mr. M. Long. July 1981. Mayor of Waynesville, MO. Letter and questionnaire concerning urban socioeconomic statistics.

166. Mr. Charles Lopez, July 1981. U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center (ETL/TAC), Fort Belvoir, VA. Telephone conversation concerning river port guidelines.

167. Mr. Harold R. Martin. July-August 1981. Airport Manager, Rolla National, Vichy, MO. Letters concerning Rolla National Airport facilities.

168. Mr. Franklin L. Matthews. 1 July 1981. Movement Services Branch, Transportation Division, Directorate of Industrial Operations, Fort Leonard Wood, MO. Telephone conversation concerning railroad and transportation movement on post.

IV. LIST OF SOURCES (Continued)

169.

Mr. Don E. Miller. June 1981. Missouri Department of Natural Resources, Rolla, MO. Interview concerning ground water resources.

170.

Mr. Paul Minor. 1 September 1981. U.S. Department of Agriculture, Soil Conservation Service, Columbia, MO. Telephone conversation concerning soils analysis on Fort Leonard Wood.

171.

MAJ Robert L. Moore. June-September 1981. Aviation Officer, Aviation Branch, Directorate of Plans, Training and Security, Fort Leonard Wood, MO. Interview and telephone conversation concerning status of airfield operations and location of official helicopter landing areas on the reservation.

172.

Mr. Scott Murrell, August 1981. Energy Management Office, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning fuel oil consumption on post.

173.

Mr. Ray Mutchler. 1 October 1981. Rolla National Airport, Vichy, MO. Telephone conversation concerning runway weight bearing capacity.

174.

Mr. Terry Nixon. 17 June 1981. Chief, Energy Management Office, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning electricity, fuel oil and liquid propane gas information.

175.

Dr. Jack Planalp. 22 July 1981. U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center (ETL/TAC), Fort Belvoir, VA. Telephone conversation requesting mean snow-depth records for the Fort Leonard Wood area.

176.

Mr. James Nunley. 19 June 1981. Chief Billeting Branch, Housing Division, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning troop billets on post.

177.

LTC Homer C. Ply. August 1981. Director, Directorate of Communications-Electronics, Fort Leonard Wood, MO. Interview concerning telecommunications capabilities on post.

178.

Mr. Mark Premont. June-October 1981. Master Planner, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interviews and telephone conversations concerning acquisition of data for various topics.

179.

Ms. Patricia Ray. August-September 1981. Chief of Rail Operations, Material Movement Section, Directorate of Industry Operations, Fort Leonard Wood, MO. Telephone conversations concerning rail operations.

180.

Mr. Donald Schaffer. 11 September 1981. Communications Manager, U.S. Army Communications Center, Fort Leonard Wood, MO. Supplied official telephone information.

181.

Ms. Barbara Seaman. June 1981. Budget Clerk, Budget Administration, Energy Resource Management Division, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning water supply availability on post.

182.

Dr. A.C. Spreng. June 1981. Department of Geology, University of Missouri, Rolla, MO. Interview concerning geology of Fort Leonard Wood.

183.

CW3 Ronald Stamschror. August 1981. Helicopter pilot, Fort Leonard Wood, MO. Interview concerning airfield operations.

184.

Mr. Marion Summerford. 19 June 1981. Chief of Housing Division, Directorate of Facilities Engineering, Fort Leonard Wood, MO. Interview concerning family housing on post.

185.

Mr. Robert Tucker. 27 August 1981. Customer Services Supervisor, United Telephone Company of Missouri, Rolla, MO. Telephone conversation concerning telecommunication on post.

186.

Mr. Jerry Vineyard and James H. Williams. June 1981. Engineering Geology Department, Division of Geological Survey and Water Resources, State of Missouri, Rolla, MO. Interview concerning soils and geology of Fort Leonard Wood.

187.

Mr. Thomas Wert. 28 July 1981. U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center (ETL/TAC), Fort Belvoir, VA. Telephone conversation concerning post road classification.

188.

LTC John T. Wettack. August 1981. Public Affairs Officer, Public Affairs Office, Fort Leonard Wood, MO. Interview concerning purpose and use of Fort Leonard Wood terrain study.

189.

Mr. Pete Wilson. August 1981. Railroad Foreman, Directorate of Industrial Operations, Fort Leonard Wood, MO. Interview concerning railroad characteristics.

190.

Mr. David W. Wolf. June-September 1981. U.S. Department of Agriculture, Soil Conservation Service, Camdenton, MO. Telephone conversation and interviews concerning soils analysis on Fort Leonard Wood.